What's ahead

Two In One

Our No. 1 New Year's resolution is to make *Chem. & Met.* more interesting and more useful to more chemical engineers and production executives. So next month in our 16th Annual Review Number we bring you a double-header! In addition to the usual editorials, articles, news and departments, there will be a special statistical section on raw materials and products of chemical process industries. New Census data, supplemented by original *Chem. & Met.* distribution studies, will help you in planning plant operations for 1939.

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CHEMICAL & METALLURGICAL ENGINEERING

Volume 46 • Established 1902 • Number 1

JANUARY 1939

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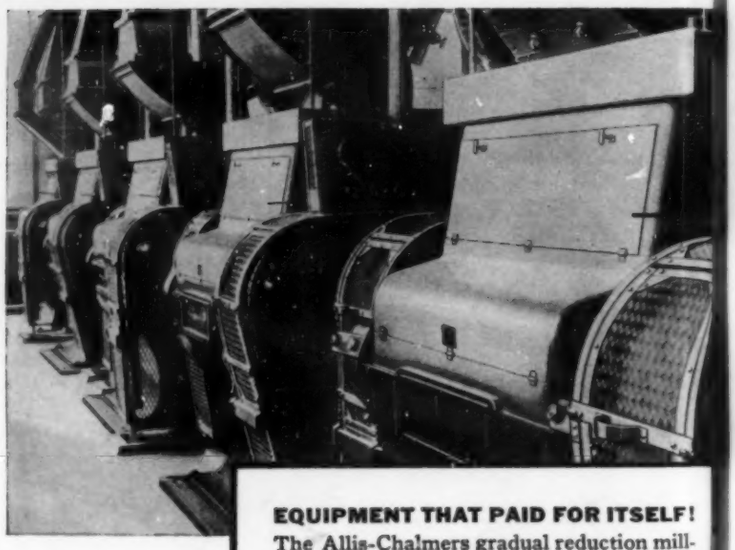

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875

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CHEMICAL & METALLURGICAL ENGINEERING
ESTABLISHED 1902

JANUARY 1939

S. D. KIRKPATRICK, *Editor*

Towards Economic Virility

IS THERE A LESSON for American chemical engineers in what is happening beyond the borders of U.S.A.? In the kaleidoscope of economic and political developments abroad, are there technical implications that will ultimately affect the progress of our technology here? There seems to be no escaping the fact that the world has suddenly shrunk very small and that American industry during the next year or two will face an increasing number of international problems. Perhaps, then, it is time that we began a more careful appraisal of foreign trends and developments.

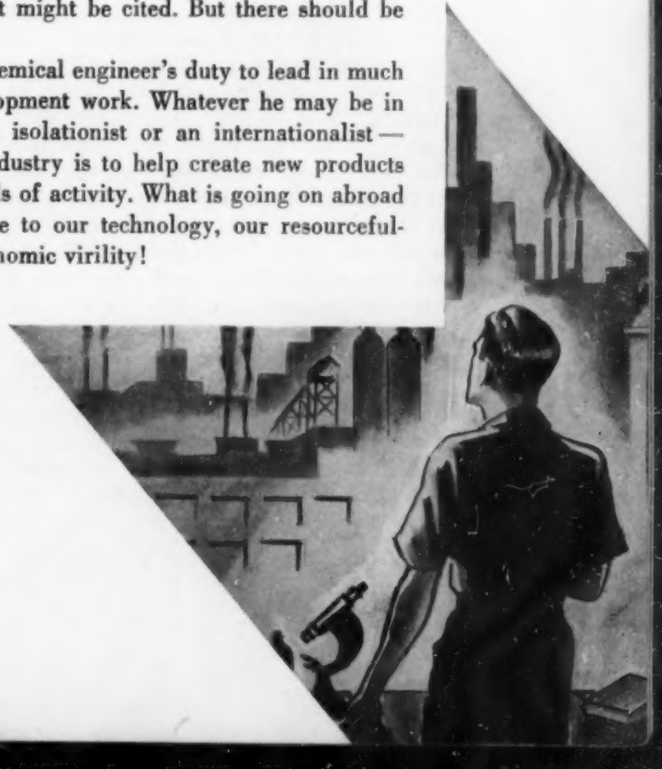
The trade agreements with Great Britain and Canada, which went into effect on January 1, are but one evidence of this necessity for more intimate study of world affairs. Relatively few portions of these important tariff documents have anything to do with chemical industry. Yet in their broader implications, they may greatly increase our indirect competition by swelling the imports of finished goods made with foreign chemicals. Or, as the benefits are extended to other nations, there may be dangerous shifts in our foreign trade. In some measure such trends can affect every chemical enterprise, big or little, regardless of the raw materials used or the products made.

What has been happening in Lima has industrial as well as political significance. It means that real thought must be given to the need for assisting American enterprise in dealing with our Latin American neighbors. We want to know more about their chemical requirements and needs for engineering services. Unfortunately, it is not clear that the State Department fully understands the industrial aspect of this part of its job.

Still another problem in international relations affecting chemical industry is the insistent demands of Germany and Italy for colonial territory. Lacking essential raw materials that might thus be obtained, both countries have launched autarchial programs in which chemical engineering is playing a vital role. Governmental subsidies are carrying much of the cost of research and development for a great many important products and processes. Some day some of these are going to be in direct competition with American enterprise. This competition will come sooner and be more serious if we are content to rest on our present achievements.

As chemical engineers we have an opportunity — if not an obligation — to develop many new raw materials, new products and new processes which will more nearly stabilize and integrate American business. In the past twenty years some of the strategic materials for which we were once dependent on foreign sources have now become commonplace commodities of domestic origin. Nitrogen, potash, camphor, iodine are but a few of many examples that might be cited. But there should be even more!

It is the chemical engineer's duty to lead in much of this development work. Whatever he may be in politics — an isolationist or an internationalist — his job in industry is to help create new products and new fields of activity. What is going on abroad is a challenge to our technology, our resourcefulness, our economic virility!



From an

NEW DRESS FOR NEW YEAR

DID YOU HAVE ANY DIFFICULTY in recognizing us this month? We are not surprised if you did, for in all of our 37 years, *Chem. & Met.* has appeared with advertisements on its front covers. Now that valuable space has been released for our own use and we hope to make it an attractive introduction to the features you will want to find within the editorial pages. For a time, at least, we shall continue to vary the color of our dress each month. Hence, don't be too hasty this month in accusing us of yellow journalism or next month of being green, or blue, or red, or even slightly pink!

Beginning also with this issue is an editorial feature that seems to have interesting possibilities in these days of visual education. Projecting the process flow sheet into the plant is the chemical engineer's job. To help visualize that projection, we plan to present a series of *Chem. & Met. Pictured Flow Sheets* in which both new and standard processes will be shown in photographs from modern plants in American industry. There will be occasional data sheets and other reference information in this special insert between the articles and editorial departments. We hope you like it and find it useful.

ENGINEERS AND AUDITORS

ONE OF THE IMPORTANT limitations on auditing as presently practiced is to be seen in the almost unbelievable sweep of the deception revealed in the case of McKesson & Robbins, Inc. It seems to suggest one needed remedy in which the engineering profession might be asked to take a hand. This remedy relates to the verifying of industrial inventories. Engineers might well work with auditors on any project where an adequate determination of the status of an enterprise involves the checking of quantities and values of industrial goods. Statisticians can verify books and securities, but a different type of knowledge and experience is required when the appraisal of inventories becomes necessary. It would be unfortunate if as a result of this fraud there were generated a panicky demand for excessive detail in the auditing of all physical goods. But there may be cases where a certain amount of checking by independent technical men would seem a logical supplement to the appraisals of staff engineers and executives. Chemical industries are likely to be involved in problems of this sort, so some thought might well be given now to plans for engineering appraisal whenever occasion warrants.

WAGE-HOUR EXEMPTIONS

PROFESSIONAL WORKERS are exempted from the maximum hour limitation of 44 hours per week set by the law establishing the Wage Hour Division of the Labor Department. This fact was a recognition by Congress that those who are engaged in professional work cannot always confine their activities to the time-clock schedules provided for those wage earners engaged on an hourly basis.

There has been needless anxiety among industrialists as to whether their research men and other important technical workers had to be limited to 44 hours a week, or be compelled to accept an overtime status. Neither the law nor the actions of Administrator Andrews justify that fear. The important thing is to be sure that professional men are treated as such, and that their work is truly professional in nature, not mere routine.

There is a good prospect that the Federal advocates of the Wage-Hour Law will request Congress for still further exemptions. It is being suggested that any person getting more than $3,000 a year be exempted from the 44-hour weekly limit. It probably will be wise to have such exemption provided. As yet it is not available under the law; but there is adequate exemption for those who really do professional and executive work.

GETTING AT THE FACTS

THAT A FACTUAL and objective study of the patent system is to be made by an engineering group working under the joint direction of National Industrial Conference Board and American Engineering Council is indeed good news. Industrial executives generally will appreciate the urgency of getting at both technical and economic aspects of this question. Washington studies from an official point of view are not enough. Facts must be gathered from the standpoint of the inventor and industry as well.

The patent system has contributed tremendously to the economic and social well being of America. A system of its importance cannot safely be tinkered with. There may well be, probably are, important opportunities for improvement. Changing Ameri-

Editorial Viewpoint

can conditions should be taken into account by changes in the system, where necessary. But changes of this sort should be made on the basis of factual studies.

If A.E.C. and N.I.C.B. can carry through a thorough, well-balanced, forward-looking study they will contribute very greatly to the advance and the betterment of the patent system. That is just as important as is the protection of the system against impetuous reformers or ill-advised advocates of radical change.

BE IT RESOLVED

THIS IS THE TIME of the year when most of us resolve to improve certain of our habits that we consider are not just what they should be. Managements who are following this ancient custom might well consider the growing evils of reciprocal buying. As J. F. Lincoln of the Lincoln Electric Co. has recently stated, "Industry, at great expense, sets up a purchasing department, an inspection department and an engineering department, to produce material of proper price and quality. After having done this it puts in a reciprocal relations department, which overrides the decisions of the buyer, the inspector and the engineer. This results frequently in strained industrial relations since no one can buy in a volume to satisfy the reciprocator. Not only that, but the distribution is never fair from the seller's point of view."

Reciprocal buying results in higher prices, in lower quality and in a lack of standardization which enormously increases maintenance costs. It should be brought to an end by management before such action is forced upon industry by government regulation.

POISONOUS "BEVERAGES"

RETAIL DEALERS in industrial chemicals occasionally use old bottles as containers for small quantities of poisonous materials. Hardware and paint stores are inclined to put methanol, denatured alcohol, hydrochloric acid, and other liquids of toxic character into the most convenient container that can be picked up in the backroom or is offered by the would-be purchaser. The results are often serious as the poisonous material may later be mistaken for a beverage.

Manufacturers of chemicals cannot control all these practices nor are they legally or morally responsible for policing of the whole business structure. Nevertheless, all chemical makers will want to do anything in their power to make accidents from these bad retail practices less likely to occur. In a few cases it appears that the solution to the problem is to market the chemicals which go ultimately to artisans or householders in small quantities in containers properly labeled, and thus unlikely to be mistaken for other materials.

If the merchandising companies to which such chemicals go will only consider the cost at retail of filling containers by hand, with considerable chance of waste and loss, they may be more willing to accept these products already packed in retail units even though the initial cost may be a trifle more than for bulk distribution. The net profit to the merchant will actually be greater. Chemical makers can well use their influence in this direction by themselves offering, or arranging for their wholesalers to offer, suitable retail packages. They will thus materially contribute to the cause of public safety.

Volume 46—Chemical & Metallurgical Engineering—Number 1

Chemical & Metallurgical Engineering is the successor to *Metallurgical & Chemical Engineering*, which in turn was a consolidation of *Electrochemical & Metallurgical Industry* and *Iron & Steel Magazine*, effected in July, 1906.

The magazine was originally founded as *Electrochemical Industry*, in September, 1902, and was published monthly under the editorial direction of Dr. E. F. Roeber. It continued under that title until January, 1905, when it was changed to *Electrochemical & Metallurgical Industry*. In July, 1906, the consolidation was made with *Iron & Steel Magazine*, which had been founded eight years previously by Dr. Albert Sauveur. In January, 1910, the title was changed to *Metallurgical & Chemical Engineering*, and semi-monthly publication was begun Sept. 1, 1915. On July 1, 1918, the present title was assumed and weekly publication was begun Oct. 1, 1919. Monthly publication was resumed in March, 1925.

Dr. E. F. Roeber was editor of the paper from the time it was founded until his death on Oct. 17, 1917. After a brief interim he was succeeded by H. C. Parmelee. Ten years later, Nov. 1, 1928, Mr. Parmelee assumed other responsibilities in the McGraw-Hill Publishing Company and was succeeded in the editorship by Sidney D. Kirkpatrick.

The editorial staff of the magazine comprises: James A. Lee, managing editor; H. M. Batters, market editor; T. R. Olive, associate editor, Melvin E. Clark, assistant editor. R. S. McBride, Paul D. V. Manning and E. S. Stateler are editorial representatives in Washington, D. C., on the Pacific Coast, and in Chicago, respectively.
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Prospect and Retrospect

How the sharp recession followed by the equally sharp recovery affected the chemical process industries of the United States. What's ahead for the industry and profession in 1939?

WHAT WAS RATHER POLITELY TERMED the 1938 "recession" at first threatened to have more serious effect on chemical industry than even the disastrous depression of 1932-3. Never before in the history of the American industry had general business dropped so precipitously as in the six months from August 1937 to February 1938. Markets disappeared so rapidly and completely that many chemical manufacturers were stunned and bewildered. They seemed to forget entirely the lessons of the previous depression. Five or six years before, as business had gradually receded, they had concentrated on cutting costs and lowering prices. They had called on their research laboratories for new products and processes which were quickly translated into commercial production—to the immense benefit and credit of the entire chemical industry.

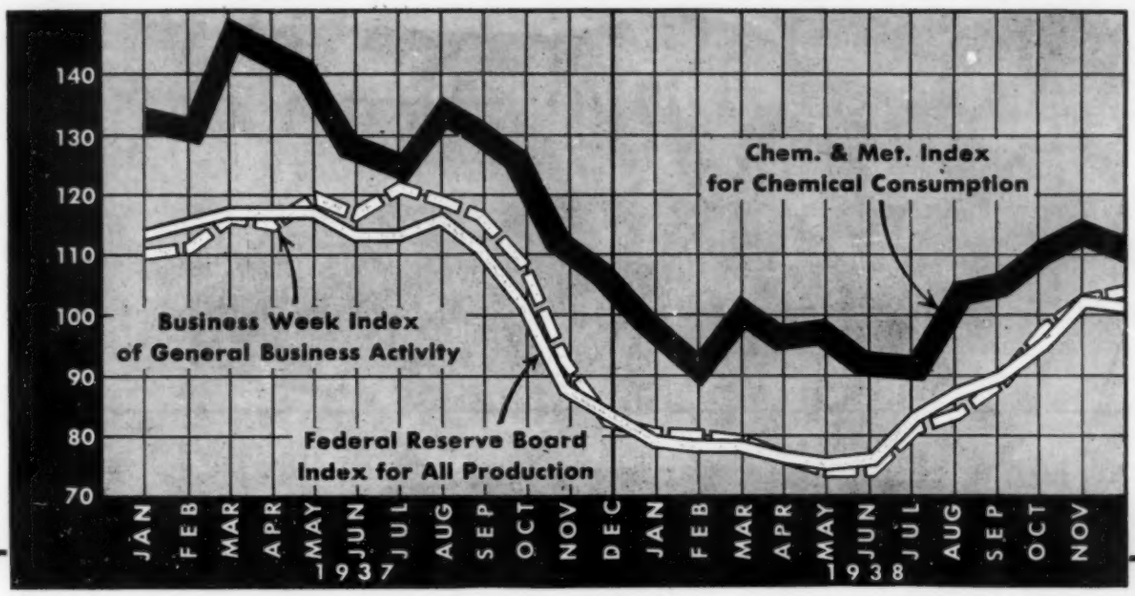
This time it was different. It was not until the early summer of 1938 that the American chemical industry began to realize that it could not advance in the absence of a general business recovery unless it pushed actively ahead with the development of new materials. The rayon, resin and plastic producers were the first to answer the call and within a matter of weeks, a complete change of sentiment was evident in the industry. Fortunately, too, general business recovery got under way about the same time. The Federal Reserve Board index for all industrial production, which had reached a low in May of 76 (per cent of 1935) started upward in June, rising rapidly to finish the year at approximately 100. *Business Week's* index of general business activity was a little slower in getting under way, but after it had reversed its trend in June, the rise was even more striking. For the six months June through November, the improvement in business was greater than any previously known to have occurred in a comparable period. December brought a slight tapering off of the upward trend, but most observers feel that this is but a temporary interruption of a long time recovery movement that will continue far into 1939.

What about 1939?—Colonel Leonard P. Ayres, whose forecasts have long received most credence in banking circles, believes that we shall now see an orderly advance to levels comparable to those reached in the peaks of 1937, that we may confidently expect a great improvement in new plant and residential construction, that the petroleum, rubber and glass industries may look forward to new high records in production. In chemical industry, we believe it will be safe to add rayon, plastics and many synthetic organic chemicals to the probable record-breakers for 1939. Sulphuric acid and the alkalis, which set all-time highs in 1937, should not be far behind in 1939.

New Chemical Yardstick—Chem. & Met. readers must wait until next month's annual review number for the detailed commodity records and predictions but some reference should be made here to one more measure of general business that is of special interest to chemical industry. With the exception of a relatively few commodities, current statistics on the American production of chemicals are not readily available. Furthermore, because of the wide diversity of chemical manufactures, trade estimates of productive activity usually have particular rather than general application. We do have, however, excellent figures for current production in most of the industries which are the largest consumers of chemicals. Such data as the amount of crude oil run to stills in the petroleum refineries, the hides in soak in leather plants, and the crude rubber consumed in rubber factories can be translated, with fair accuracy, into a measure of the quantities of chemicals consumed in these industries.

Through proper weighting and interpretation of such figures, Henry M. Batters, market editor of *Chem. & Met.*, has evolved a Weighted Index of Chemical Consumption. As carried forward from month to month, we now have a most useful gage of overall productive operations in American chemical industries. And because the separate figures for the different consuming industries are also published currently, the chemical manufacturer can use his own weightings in preparing a sensitive index of trends in the markets with which he is most concerned.

This new index of chemical consumption is compared with those for general business and for all industrial



production in the accompanying chart. It will be noted that when this index turned upward this summer from 92.7 in July, it mounted rapidly to 113.7 for November—a rise in total chemical consumption of almost 25 per cent in four months. It still has a considerable climb ahead, however, if it is to reach the peak of 148.45 recorded in March 1937.

Our National Defense—Least popular of all subjects with the average chemical manufacturer is the part that our industry would be called upon to play in time of war. The World War boom and collapse of many chemical enterprises is remembered all too well. It is indisputable that war demands on any industry diverts it temporarily from its long-time objectives and that in the long run most progress and profits as well result from peacetime developments. Nevertheless it is apparent that chemical industry cannot and should not shirk its important responsibility in the industrial mobilization program that is gradually getting under way in this country. Chemicals are so vital to so many different arms of defense and services of supply that a comprehensive procurement program should be worked out between government and industry at an early date.

Following the ascertainment of future requirements, there must shortly be made a comprehensive survey to determine the capacity of our industries to supply war-time needs. Certain companies must be encouraged to experiment in the development and production of highly specialized materials that would be promptly needed in the event of a national emergency. And, finally, there must be an accumulation of adequate reserves of certain strategic minerals and essential raw materials which are not readily available from domestic sources. All this can and should be done with the minimum disturbance or interruption of normal industrial development.

Such a program overlooks, for the moment, at least, what is probably the single most important consideration, namely, the availability of key personnel among technical men who are competent to take over the serious responsibilities of initiating and directing control of chemical enterprises essential to the national defense. There is a lesson for us in what is happening today in England, Germany and Italy.

Professional Progress—While of necessity the chemical engineer is primarily concerned with the job of producing or selling goods or services, he has a further obligation and responsibility as a member of a rapidly growing branch of the engineering profession. It is his duty to contribute what he can to the common cause of professional development. The opportunity begins with the selection and guidance of the better qualified, high school students who seek admission to our engineering colleges and universities. It continues with the responsibility for helping to improve and strengthen our facilities for chemical engineering education. After graduation there is an even more important four- or five-year period in which the young engineer can be greatly benefited by the advice and example of older men in the profession. And finally, there is the goal of ultimate professional recognition by the state and the public at large, which must in time be brought to a better understanding of the role of the chemical engineer in the local community as well as the national economy.

All this calls for a greater participation by the individual in the affairs of the profession—in local as well as national activities. More and more companies are beginning to realize the values to be gained by promoting the professional development of their technical personnel. It is an encouraging sign of the times and one that augurs well for continued progress of chemical engineering in 1939.

Sidney D. Kirkpatrick

As Great Britain Re-Arms

So far her heavy engineering industries have been most affected but the rearmament program is beginning to stimulate the production of solvents, plastics, sulphuric acid and ammonia. Chemical manufacturers seek to work in closer cooperation with government.

T. W. JONES
Editor
The Industrial Chemist and Chemical Manufacturer
London, England

THE YEAR 1938 was one of international stress in the chemical and allied industries of Great Britain. The tension reached its peak during the last week of September and the first week of October when the Fleet was mobilized, military preparations made, the Air Force suitably aligned, trenches and dugouts for the civilian population dug in London and the chief provincial city parks, and London school children evacuated to the west of England. The effect upon business, although noticeable, cannot be regarded as having been as severe as the Jeremiahs prophesied.

General business activity fell off steadily during the summer, but has shown pronounced recovery since early October. On the other hand, there is no gainsaying that the almost continuous upward movement since 1932 has been sadly interrupted. Furthermore, European instability does not promise much for the New Year. The Board of Trade Index figures for the chemical and allied industries were as follows for the first three-quarters of the year: Taking the production of 1930 as 100, first quarter, 123.5; second quarter 115.0 and third quarter, 113.5. These should be compared with the recent peak in the second quarter of 1937 of 126.4.

Except in so far as it has delayed constructional work by reason of its demand for iron, steel and other metals and on the other hand has stimulated the production of solvents and plastics and certain heavy chemicals, the rearmament program of the country has had only small effect upon the chemical and allied industries. As Lord Hirst, in his presidential address to the Federation of British Industries, pointed out, the £300 million per annum of the program amounts to only about 8 per cent of our total production. In his own words, "not a sufficient factor to create a dangerous hold-up." Furthermore, it is felt chiefly by the heavy engineering industries.

So far little influence has been felt by the chemical industries from what are euphemistically termed the "emergency" measures, such as, for example, the Air Raids Precautions and the Essential Commodities Reserves Act. Although the latter gives power over the control of a wide range of chemical products, as well as food, its activities have so far been confined to wheat, sugar and whale oil purchases. The Ministry for the Coordination of Defence has arranged for ample supplies of the rare metals and materials needed to carry the country through a long war. Through the cordial cooperation of industry, this has been achieved without disturbance of the markets. Furthermore, industry has cooperated in the dispersal outside London of several types of essential stores.

In spite of these activities, however, the British chemical industry has been adversely impressed by the lack of governmental leadership, and particularly so by the fact that no indication was forthcoming during the "crisis" (as the September-October days are now called) as to what was expected from industry by the government in arranging ordnance priorities or other related matters. In a debate in the House of Commons upon the subject of Air Raid Precautions, the Home Secretary announced that the cost of provisions and maintenance by industrialists of structural alterations, such as additions to premises and the construction of bomb-proof cellars for the safeguarding of their staffs, could be returned as expense for income tax purposes, thus removing a bone of contention that has been squabbled over for some months.

Overseas Trade—Further evidence that the trade decline in chemicals has been only comparative is to be found in the overseas trade figures for the first ten months of 1938. Although imports, exports and the entrepot trade show decreases compared with the corresponding ten-months' figures of the preceding year, yet they represent an appreciable advance beyond the 1936 totals. The ten months' exports of chemicals, drugs, dyes and colors were valued at £18,412,348, which was a decrease from the same period in 1937 of £2,329,356, but an increase when compared with 1936 of £1,078,313. The comparable import figure of £11,059,709 shows a decrease of £239,041, but an increase over 1936 of £677,720. It may be that in the final two months of the year, the export figure will improve inasmuch as October was a better export month in 1938 than in the two previous years.

The Empire is the largest customer for chemicals and allied manufactures of the United Kingdom. British India is the largest single customer either within or without the Empire. The order of importance among the Dominions is as follows: Australia, South Africa, and Canada. The United States is the fifth largest customer but the most important non-Empire customer. However, the demand from the United States during the first ten months of 1938 has fallen to £795,869 as compared with £1,249,813 and £1,024,493 for same periods in 1937 and 1936.

The chief supplier of British demands for chemicals, drugs, dyes and

colors, is Germany and the second most important is the United States. Both have shown decreases but these have been slight as compared with the percentage fall in imports from Spain, Japan and the Argentine. Finished dyestuffs from coal tar are supplied to the extent of about two-thirds by Germany. The imports from Chile show a substantial increase due almost entirely to increased receipts of nitrate.

Tariff Changes—The chief alterations in the tariff affecting overseas trade are those embodied in the Anglo-United States Trade Agreement signed in Washington on Nov. 17, 1938. Although the commodities affected by the agreement lie chiefly in the domain of foodstuffs, chemical and allied products are not unaffected. Great Britain has taken off entirely or reduced the duties, upon a number of chemicals, whereas the United States has halved the duties on the majority of the chemicals concerned. The annual turnover of imports into Great Britain that are affected amount to something over £2,000,000 per annum, whereas the exports to the United States that are affected amount to little over $400,000.

A significant change in taxation made by the Budget (as the annual Finance Act is colloquially called) was an allowance of 10 per cent under Section 18 of the Finance Act, 1932, which deals with allowances in income tax for depreciation of plant and machinery: the allowances previously made were about 7½ per cent for heavy chemical equipment and 15 per cent for synthetic dyestuffs and similar machinery.

Home Trade—Price fluctuations during the year have shown a distinctly downward tendency, and thus the international situation has falsified those optimistic prophets who, reasoning from the activity of 1937 and the opening of 1938, had led us to expect a generally higher level of prices. During the closing weeks of 1938, the contracts for 1939 were under review for general chemicals and raw materials and it is reported that a fair proportion of forward bookings has been made.

Fertilizers were quiet throughout the year and followed the usual seasonal trends. The Land Fertility Scheme, under which the State pays half the cost of lime and one-quarter that of basic slag used by farmers for fertilizing land, has stimulated consumption of these—in fact, the demand has encouraged the reopening of several disused kilns and the building of some new ones. At the end of November over 300,000 applications from farmers for such contributions had been received, representing 2,160,000 tons of lime and 577,000 tons of basic slag.

Sulphuric Acid—The general industrial recession of the first two-thirds of 1938 is reflected by the sulphuric acid production—the figures for which are shown in the table on the following page.

These figures reveal an interesting increase in the proportion of acid made by contact process. This is also evident from the import figures for

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Acetone and butanol units, Hull works, British Industrial Solvents, Ltd.

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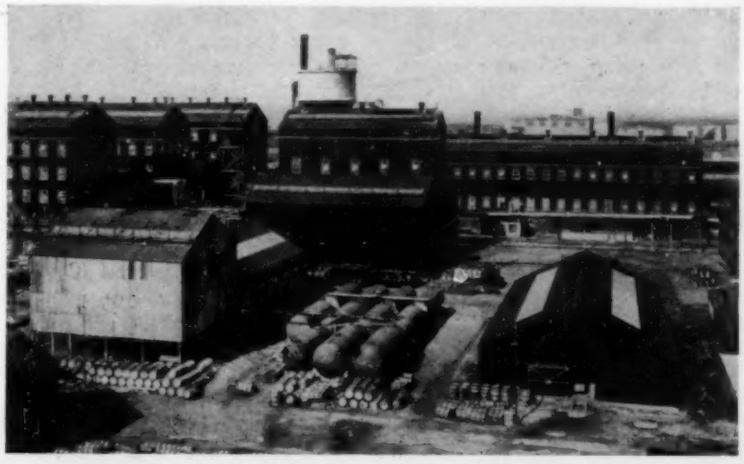
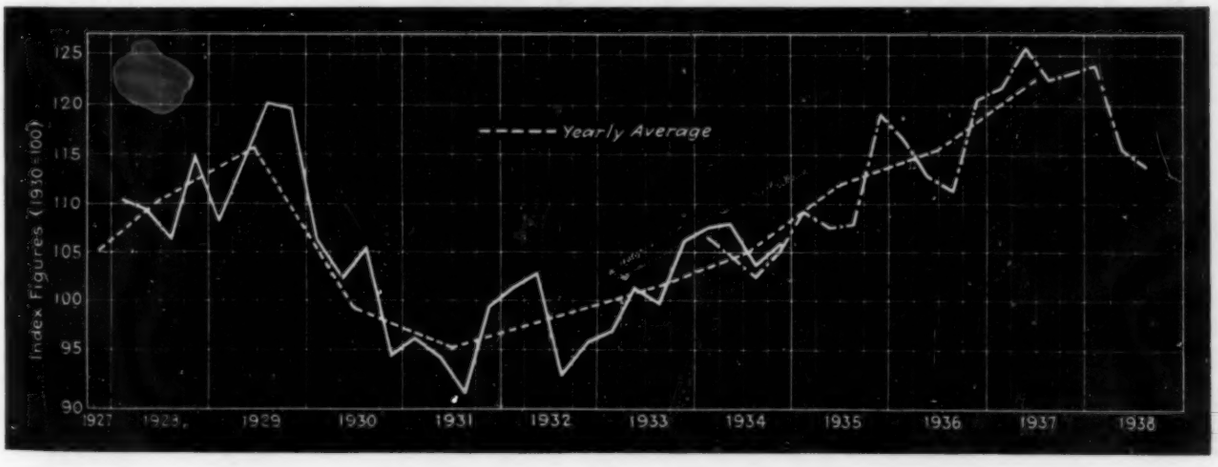
The British Board of Trade Index of Production for the Chemical and Allied Trades. Two quarterly lines are shown for 1934 because of slight changes made then in composition of the Chemical and Allied group which now includes heavy chemicals and explosives, synthetic dyes, ammonium sulphate, sulphuric acid, copper sulphate, cellulose acetate, oxygen, acetylene, matches, soap, vegetable oils and petroleum refining





Production of Sulphuric Acid in Great Britain

First Three-quarter Yearly Figures in Tons of 70 Per Cent H_2SO_4

	Chamber	Contact	Total
1st quarter 1938	268,000	135,300	403,300
2nd quarter 1938	222,000	109,200	331,200
3rd quarter 1938	194,500	102,900	297,400
1st quarter 1937	294,500	115,600	410,100
2nd quarter 1937	280,700	115,500	396,200
3rd quarter 1937	235,800	117,600	353,400
1st quarter 1936	283,000	104,700	387,700
2nd quarter 1936	224,800	110,800	335,600
3rd quarter 1936	260,800	108,900	369,700

sulphur which have increased steadily during the last four years. Tonnages were: 1935, 85,902; 1936, 122,116; 1937, 152,869; and for the first ten months of 1938, 112,461. Sulphur will come into the country free under the new trade agreement with the United States.

Sulphuric acid plants are increasing in number. Apart from government contracts under the rearmament program, agriculture still makes its call. A large superphosphate plant is under construction at East Anglia and the third vanadium catalyst plant to be erected in this country was recently inaugurated during October at the London works of F. W. Berk & Co., Ltd. This has a rated capacity of 24 tons per day of 100 per cent sulphuric acid.

New Products—Among the new products that have been put on the market during the past year in commercial quantity, the honor for numbers must be given, as usual, to pharmaceutical preparations. Next in quantity among the introductions to the market must be ranked solvents, and plasticizers as well as new plastics. A. Boake Roberts & Co., Ltd., has put forward a number of cellulose-ether solvents as well as special solvents for chlorinated rubber. Distrene is a new transparent thermoplastic material developed by the Distillers Co., Ltd. It is said to have remarkable insulating properties and may be used either for injection or pressure molding. Rubber accelerators have been augmented by the placing on the market by Monsanto Chemicals, Ltd., of diphenylguanidine and tetramethyl thiuramdisulphide. Early in the year, Imperial Chemical Industries, Ltd., put out their Viscrome dyes for coloring spun mixtures of animal and vegetable fibers. Under the title of anodic dyes, Williams (Hounslow) Ltd., have developed dyes for use on aluminum. Howards & Sons, Ltd., have made considerable strides with their 80 per cent technical sodium lactate which may be used as an alternative to glycerine, particularly for calico dyeing.

Lithcote, a non-vitreous baking enamel which can be applied quickly and easily to any metal, has been placed on the market by Newton, Chambers & Co., Ltd. Micro-Lead Products (Ericsson) Ltd., is undertaking the manufacture of red lead by the Vaprolite process, which consists in feeding molten pig lead from a controlled electric melting furnace at a constant rate into a main vaporizing furnace heated by a three-phase carbon arc. The lead is explosively evaporated and passed into a large precipitation chamber where it comes into contact with pure oxygen and is converted into red lead of remarkable properties.

Stannising is a new process for coating brass, copper, etc., by suspending articles made from these metals for a few minutes in an atmosphere of hydrogen and stannous chloride vapor. The tin, so reduced, alloys with the metal, the thickness and composition of the alloy depending upon regulation of the temperature and time of exposure to the vapor. Bakelite, Ltd., has recently put on the market a new synthetic resin primer which deposits a coherent rapidly setting adhesive film upon timber.

New Factories—Factory expansion has continued, and probably when the figures are finally worked out, it will be found that 1938 showed greater works expansion in the chemical and allied industries than during 1937 which was an extremely progressive year. Reference has already been made to sulphuric acid plant expansion. Work was begun early in the year on the construction of an ammonia plant for Imperial Chemical Industries, Ltd., on part of the site of the demolished Moss End Steelworks near Glasgow.

Coke oven and byproduct plants have been erected, or are under construction, by three of the leading coal and iron firms, namely Baldwins Ltd., Powell Duffryn and United Steel. Two new independent works have been opened during the past year for the refining of coal byproducts—the first at the Birkenhead works of Midland Tar Distillers and the second at the Oldbury plant of the same company. The latter is the central works to which the crude products from other works such as those at Birkenhead, are sent for final refining. It is unique in that it operates continuously.

A 13-acre factory on the North Circular Road at Stonebridge Park has been completed by Celotex Ltd. Turners Asbestos Co. has built a new factory at Dalmuir on the site of the former shipyard of Wm. Beardmore & Co. The Staveley Iron & Coal Co., Ltd., has apparently emerged from the teething troubles of its sodium chlorate plant which is now functioning satisfactorily. The Liverpool Borax Co., Ltd., has recently completely rebuilt its borax factory at Runcorn.

On the metal side a great deal of expansion has naturally taken place in the heavy engineering industry, but in the new light alloy fields there has also been much activity. I. C. I. Ltd. announced at the middle of the year a major scheme of development in connection with the manufacture of light metal alloys which will take place at their Whitton works. The first half of the additional aluminum producing plant at Lochaber was put into production early in March.

Expansion continues among drug and related firms: Boots Pure Drug Co., Ltd., Roche Products Ltd., Monsanto Chemicals, Ltd., and W. J. Bush & Co., being most active.

Research—Of what might be termed the business aspects of research, Dr. A. P. M. Fleming, director of research of the Metropolitan Vickers Electrical Co., had many pertinent things to say to the British Chemical Plant Manufacturers' Association that provoked a vigorous discussion. Research, he said, had created new banking hazards. The days are past when finance could be given to a firm, or whole industry, with the expectation that no more interest by the financiers would be required for the next 20 or 30 years. New industries continually spring up with competitive materials. Research has to be financed continually to improve one's product and develop new ones. He pointed out that for a number of years his firm had devoted 2 per cent of turnover to research. Other speakers considered this high, some confessing to 0.2 per cent.

Replacing Resources With Research

As German chemical industry fights to retain its dominant position in world trade, her technologists are forced to produce practical substitutes for many imported raw materials. Autarchial control of industry has resulted in unique organization and coordination of research and development.

KARL FALK

Fresno College
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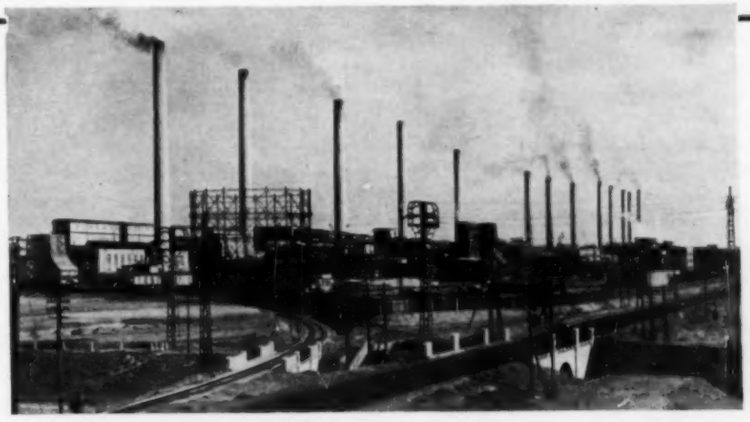
RETURNING recently from Germany where Dr. Falk served for several years as Chem. & Met. *correspondent, his first-hand knowledge of economic and political conditions is ably reflected in this remarkable summary of important trends and developments in German chemical industry.*
—Editor.



Synthetic ammonia plant, Leuna works, I. G. Farbenindustrie, at Merseburg, Germany

GASOLINE FROM COAL, rubber from lime and coal, sugar and alcohol from wood, textiles from wood or milk, nitrates from the air—all are becoming common commercial products in Germany today. Although the present economic value of some of these processes may be questioned by American critics, they merit watching because of possible competition in world trade and future applications here. In the Third Reich the German chemical industry has been given an unusual opportunity to develop new products and processes on a scale that would be impossible in a free economic system. Some of these products, even now are outgrowing the "synthetic" stage and are beginning to assert themselves in world markets.

Germany's dominant position in world trade in chemicals before the war is a matter of common knowledge. At that time, for example, Germany controlled 88 per cent of the world's dye trade. Through disruption of commerce and industrialization of former importing countries, Germany lost its position during the war. Since that time she has recovered her lead, however, and now controls approximately one-fourth of all world trade in chemicals. Germany, in 1937, exported approximately 17 per cent of her total industrial production and ranked third in world trade, following Great Britain and the United States. Her share rose from 7.8 to 8.1 per cent from 1936 to 1937 with respect to imports and from 9.3 to 9.4 per cent in exports.

Approximately one-fifth of Germany's export trade is in chemicals and allied products. In the order of their importance, leading markets for Germany's chemical exports, valued at over 700 million RM in 1937, were China, Great Britain, United States, Italy, British India, Netherlands, Switzerland, Japan, Sweden, Czechoslovakia, Brazil, Hungary, Belgium and Argentina. Lately there has been an increasing shift in the Reich trade to Southeastern Europe and Latin American countries which supply raw materials required by Germany and will take German manufactured goods in return. Much of this trade is carried on under bi-lateral trade agreements.

Organization of Chemical Industry—Factors responsible for the Reich chemical industries regaining their position in world trade since the war are intensive research, modernization of plants, rationalization of production methods, conservative financial management, development of new products, and careful study of foreign markets. Because of the absence of anti-trust regulations, chemical industries have been able to pool resources and effect economies and benefit by joint research. The essentially large-scale character of the German chemical industry is evidenced in the fact that 14,827 small plants employing from 1 to 20 workers each accounted for only 11.9 per cent of the total number of workers in 1936, while 66 large plants employing more than 1,000 workers accounted for 43.6 per cent of the total labor personnel. The total number of employees in the German chemical industries, including rubber, synthetic fiber, and mineral-oil plants, reached a new peak with 515,000 workers in 1937 as compared with 468,000 in 1936, and 453,000 in 1929. Of these, over 12,000 were qualified chemists.

The total payroll of the industry in 1937 was over 1,000,000,000 RM which was slightly below the 1929 level. That the total payroll was lower and the number of employees

higher is due to the fact that wage rates in all industries have been held down to depression levels to spread work over the largest possible number of employees. "Real" wages, as represented by buying power, have declined, since prices have risen somewhat. This is partly offset in the chemical industry by the fact that for years such firms as I. G. Farben have been very progressive in their social and employee policies and have carried on model projects such as housing, pension plans and social insurance.

The largest German chemical company and a model of its kind is the *I. G. Farbenindustrie A. G.*, Frankfort, which, including its subsidiaries and affiliates, alone employs over 150,000 workers. Organized in 1925, through the fusion with the *Badische Anilin und Sodafabrik*, Ludwigshafen, of the firm *Friedr. Bayer & Co.*, Leverkusen; *Meister Lucius und Bruening*, Hoechst; *A. G. fuer Anilinfabrikation*, Berlin; *Chemische Fabrike*, formerly *Weiler-ter Meer*, Uerdingen; and *Chemische Fabrik Griesheim-Elektron*, Frankfort, the I. G. ("Interessen-Gemeinschaft") "dye trust," as it is often known abroad, has added more affiliates in the meantime, and is said to control, directly or indirectly, one half to two-thirds of the chemical production of the country. Its gross earnings in 1936 were 705 million RM.

Leading in the potash industry is the *Wintershall A. G.*, controlling about 50 per cent of the potash output. It has also pursued a policy of integration and consolidation.

Schering-Kahlbaum A. G., manufacturers of pharmaceuticals and fine chemicals, also merged recently with *Kokswerke und Chemische Fabriken A. G.*, Berlin. Other large firms include *Dynamit A. G.* (Nobel), *Westfaelisch-Anhaltische Sprengstoff A. G.*, *Deutsche Solvay A. G.*, *Gold-und Silber-Scheideanstalt*, *Th. Goldschmidt*, *Kali Chemie A. G.*, *Ruhrchemie A. G.*, *Ruetgers A. G.*, *P. Beiersdorf & Co.*, *Bayrische Stickstoffwerke A. G.*, *Deutsche Zuendholzfabriken A. G.*, *A. G. fuer Stickstoffduenger Knapsack*, etc.

Production Gains—In value of production the chemical industry is the fifth most important in Germany with an annual production value estimated around 5,000 million RM in 1938. Exact recent production figures are not readily available, partly because of methods of statistical recording which are not overly detailed in the case of industries connected with national defense, and partly because the chemical industry is constantly widening to include producing branches such as textiles, rubber, petroleum, and metals, the production of which was formerly controlled exclusively by separate individual groups.

Production of chemicals and allied products has increased during the past three years to reach a new peak. With 1928 = 100, chemical activity. measured by number of performed man-hours rose to 112.1 in 1937, and on the basis of fuel consumption, production rose to 114.4. The chemical industry has shared in the general domestic boom (total value of industrial production rose from 17,600 million RM in 1932 to 37,500 million RM in 1937, and to over 40,000 million RM in 1938) caused largely by the rearmament, employment, and autarchic policies of the government.

Although the largest production gains were due to increased domestic consumption, in 1937 there was also an expansion of 18 per cent in exports. Under the first Four Year Plan (1933-7) primary emphasis was placed on rearmament, re-employment, and organization of German economy in accordance with the National Socialistic ideology. Under the second current Four Year Plan, even though the shortage of foodstuffs and vital raw materials has decreased, main emphasis is being placed on domestically produced substitute materials. Thus the chemical industry has been made the focus of national interest.

Development of Synthetics—Commercial production of synthetics, improved methods of conserving materials, and of utilizing byproduct and waste materials have featured chemical development in Germany during the past five years. The Reich's dependance upon imports, it will be remembered is most marked in the case of fats and oils, petroleum, rubber, textile fibers, and metals. As a result, all efforts have proceeded on the basis of the only raw materials of which Germany has an adequate, or nearly adequate, supply, namely coal and lignite, potash and salt, wood, and limestone.

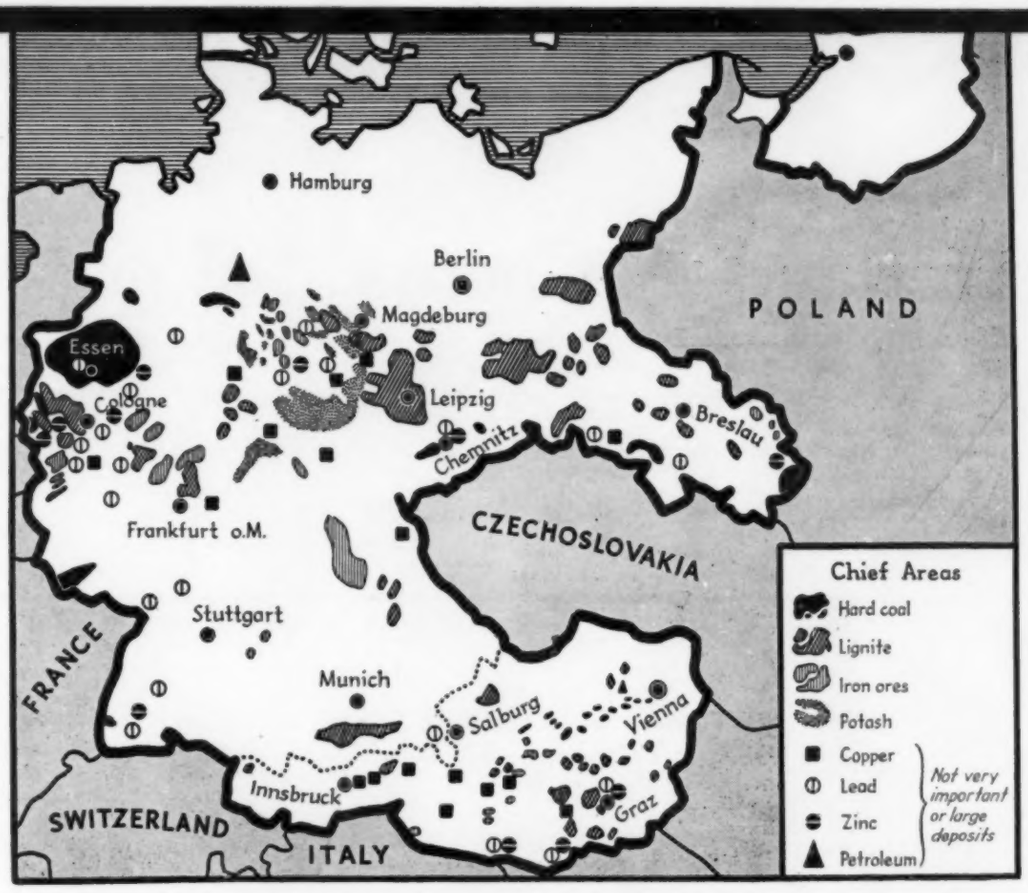
The Reich was able to supply over half its light motor fuel requirements from domestic sources in 1937, and is fast approaching self-sufficiency as new plants are being built to obtain motor fuels from lignite and hard coal, with sulphur and paraffin occurring as subsidiary products. Methanol and liquid gases, propane and butane, are being used increasingly as domestic motor fuel, as are also coke, illuminating gas, generator gas, sewage gas, etc. The change in the required admixture to gasoline of "Treibsprit" has caused considerable fluctuation in alcohol output. Agricultural alcohol production, especially from potatoes, has been discouraged while industrial production of alcohol, especially from cellulose waste liquor, has increased to boost total production in 1937–38 to 4,158 million hectoliters, following a decline in the two preceding years. One-half of this production is used in motor fuels. Alcohol obtained in wood-sugarization plants along with yeast and cattle fodder represents a new source of commercial alcohol.

Synthetic rubber ("Buna") production continues to rise as plant capacity expands. Buna, at first available only for army and postal service vehicles, is now becoming more generally available, and is reported to be used for tires even on some exported automobiles. With their various chemical and physical properties, the different Buna types are finding new uses within the chemical industry itself. Synthetic rubber producers are being subsidized by a higher tariff on imported natural rubber, the proceeds of which are turned directly into new plants. Both rubber and motor fuels will increase in importance as motorization progresses. Of the projected 10,000 km. of new motor highways about 2000 km. are already open to traffic, but the number of automobiles —one to every 45 persons—is still very low compared to U. S. A.

Synthetic textile fibers have seen a phenomenal rise. The output of "cellwool" advanced from 19,600 metric tons in 1935 to 46,000 in 1936, to 100,000 in 1937, and to an estimated 150,000 in 1938. Germany leads the world in the production of staple fiber and occupies third place in rayon. New types of fibers are constantly being perfected, and the basic cellulose will soon be obtained entirely from domestic wood.

Equally phenomenal has been the rise of synthetic resins, which are so firmly established that they are no longer considered "synthetics" in Germany. Production reached 45,000 tons in 1937 and has increased considerably since then. Phenolic condensation products account for the largest share in this field, but the demand for other types has also expanded so rapidly that production cannot keep pace. Output of pyroxylin plastics has also been mounting steadily.

The output of sulphur recovered



Important raw material resources of Greater Germany

from coke ovens and synthesis gases has expanded with the enlarged production of synthesis gases required for the manufacture of hydrogenated synthetic gasoline. Through applying the "Catasulf" process, for producing ammonium sulphate by utilizing the sulphur contained in coke oven gases, and the "Alkacid" process, the Reich intends to become independent of sulphur imports and even to enter the exporting field someday.

Research and International Cooperation—Without extensive and coordinated research, these national projects would hardly be possible. The Reich Research Council, established in 1937, and headed by a group of scientists and engineers and including several army officers, is charged with coordinating and supervising research throughout Germany to avoid duplication of effort and to speed up work on those tasks considered to be of paramount importance. Although this means regimentation of scientific research in the designation of the main problems, the actual research is left to the individual initiative of technical institutes and industries.

In general it may be said that a close, almost compulsory, cooperation exists between the industries and the government, both in research and production. The government regulates prices, the output of factories, determines what may be produced, what plants may or may not be expanded and allocates raw materials. On the other hand, since there are no antitrust regulations the industries are free to set prices and allocate markets within certain definite limits. They are given a fairly free hand in developing their products, are assured a fair, but not excessive, profit through direct and indirect subsidy, especially in the case of new and unprofitable production, are helped in their exports, and are naturally profiting by the national efficiencies obtained and by the general economic revival.

To acquaint the consuming public with new products and processes, frequent exhibits are held. German chemists and industrialists are also active in national and international scientific congresses. In connection with the 50th anniversary meeting of the German chemical society at Frankfort in 1937, "Dechema" arranged extensive displays of the latest chemical equipment and apparatus, and in 1938 the annual national meeting was held in Bayreuth. Study trips abroad are also arranged by these organizations. Among these was the visit of a number of German chemical engineers to the United States in 1937, when they inspected several leading industrial plants and research institutes. Interchanges of experience and scientific data are also aided by international congresses in which chemical engineers and scientists actively participate. Last year a large German delegation attended the 10th International Chemical Congress in Rome, and Germany will probably be well represented in the 1939 meeting in Zurich, Switzerland.

Tentative plans for the summer of 1940 involve a number of important chemical conventions of interest to American chemical engineers and industrialists. A leading place must be given the second International Chemical Engineering Congress which will be held in Berlin, June 23-29, 1940 under the auspices of the World Power Conference. It will be followed, June 28-July 7, by Achema IX, at Frankfort. This famous industrial exposition sponsored by Dechema (Deutsche Gesellschaft fuer Chemisches Apparatewesen) has always attracted engineers from all over the world. Preliminary plans for the participation of an American delegation in the Berlin Congress are now being formulated by a committee from the American Institute of Chemical Engineers under the chairmanship of Albert E. Marshall, consulting chemical engineer of New York.

Switzerland—A Chemical Workshop

Because of its bounteous natural energy and the resourcefulness of its people, Switzerland is unique among chemical countries. It is an outstanding producer of dyes, heavy chemicals, pharmaceuticals and electrochemical products.

JULES BEBIE

Consulting Chemical Engineer
St. Louis, Mo.

EXPORT OF MANUFACTURED GOODS is the economic lifeblood of Switzerland. Devoid of all basic raw materials—with the exception of salt and limestone—the little country makes its living by adding labor and skill to imports. Products thus made are sold to world markets—markets long cognizant of the Swiss reputation for high quality—especially in chemicals, watches, machinery and textiles.

The Swiss chemical industry has kept pace with the general upturn of business—an upturn reflected by a figure of 7,000,000 tons of exports in 1937, valued at 1.29 billion Swiss francs.* Of this total, chemical industry accounted for 77,000 tons valued at 246 million francs. The chief active groups were dyestuffs, aluminum, industrial chemicals, pharmaceuticals and toilet articles, perfumery products and cosmetics. Swiss chemical and allied industries have approximately 300 manufacturing companies with a total invested capital of over 300,000,000 francs, and they employ about 20,000 people. Since the general picture of the development of Swiss chemical industry was presented in *Chem. & Met.* a few years ago by A. Wilhelm (see May 1936, pp. 262-4), it is the endeavor of this article to discuss only recent trends and matters not included in the previous article.

With a progressive development record of 60 to 80 years behind them, the chemical plants centered in Basel continue to be the predominant factors in Swiss chemical industry. There are five leading companies: Society of Chemical Industry (Ciba), Sandoz, and Geigy—all producers of coal-tar dyes, pharmaceuticals, and industrial chemicals; Durant & Huguenin, which concentrates on dyes; and Hoffmann-LaRoche, manufacturers of pharmaceuticals exclusively. All of these companies are in strong positions because of their intensive research and product development programs. In addition, agreements among the three principal dyestuff producers, providing for exchange of information and cooperative purchase of raw materials, have tended to increase the efficiency and flexibility of this industry.

Over 7,000 tons of coal-tar dyes were exported in 1937 amounting to more than 85,000,000 francs. In turn, Switzerland imported 13,000,000 francs worth of coal-tar intermediates, mostly nitrobenzol, aniline and derivatives, benzyl chloride, naphthol, etc. Other chemicals used in the manufacture of dyes are produced in the Ciba electrochemical plant in Monthey, Canton of Valais. Some coal-tar products are obtained from the gas industry. City gas works produced in 1937 257,000,000 cu.m. of gas and 30,000 tons of tar and pitch, which was distilled by a central plant located in Pratteln. Increased competition from foreign countries has caused the dyestuff industry to pay especial attention to the manufacture of the more valuable classes of dyes such as special dyes for use with artificial and mixed fibers. In recent years about 50 new dyes have been placed on the market annually by the Basel companies. There is also a trend toward increased production of industrial chemicals, particularly in the field of textile and leather auxiliaries such as wetting, softening, dulling, humidifying and synthetic washing agents by these companies. Further, their more recent activities have included the manufacture of several new synthetic resins.

The pharmaceuticals industry has been stimulated by the brilliant investigations and syntheses of hormones and vitamins at the University and the Eidgenoessische Technische Hochschule in Zurich as well as in some of the industrial laboratories—notably Hoffmann-LaRoche and Ciba. Sandoz has made fundamental contributions in the field of alkaloids. Exports in this category were valued at 44,000,000 francs in 1937.

One of the oldest and most important of Swiss chemical industries is the manufacture of perfumeries. Steady development of new products, natural and synthetic, and modernization of plant equipment have helped the industry to maintain a strong position in recent years. The principal companies are in the Geneva district.

Switzerland does have one raw material in abundance—and that is power. Although there is no coal available, numerous hydroelectric plants furnish cheap power and have made possible a large electro-chemical and electro-metallurgical industry along the rivers Rhine and Rhone and in some of the Alpine valleys. They produce aluminum, magnesium, calcium carbide, acetone, acetaldehyde, acetic acid, chlorates, cyanides, ferrous and aluminum alloys, abrasives and polishing agents. The electrical energy requirement of these industries in 1937 was 1.28 billion kw.-hr. There are two leading companies: The Aluminum-Industrie A. G. Neuhausen (AIAG), has plants in Neuhausen on the Rhine (the cradle of the European aluminum in-

*At the current rate of exchange approx. 4.42 Swiss francs are equivalent to one U. S. dollar.

dustry), and in Chippis and Martigny, Canton of Valais. The Lonza Co. has plants in the Valais and the Canton of Tessin. Aluminum is exported in all forms and compositions including manufactured articles and equipment. Total exports in 1937 amounted to 27,300 tons valued at 57,000,000 francs.

Although Swiss aluminum industry is no longer the chief producer of the metal in Europe, it has established branch factories in other countries and maintains its position in all important technical developments of the field. Swiss companies, like the American and French, produce a grade of aluminum of extremely high purity—99.99 per cent and over. Likewise numerous high strength and corrosion resistant alloys in aluminum have been developed. The Neuhausen company has built the first European heavy 3-high rolling mill and extrusion press for aluminum alloys. An example of this company's new alloys is Anticorrodal which, on account of its good mechanical properties, silver-white color and high resistance to corrosion, is finding wide application in construction work in the building, transportation and industrial fields. Switzerland imports all of its aluminum oxide and in 1937 these imports amounted to 60,000 tons valued at 12,000,000 francs.

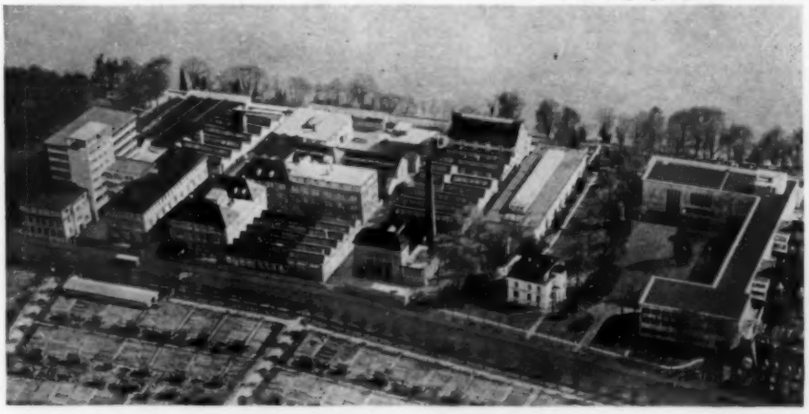
The heavy chemicals industry supplies all or most of the domestic requirements for: salt, soda ash (30,000 tons annually), caustic soda, chlorine, ammonia (13,000 tons per year synthetic and 1,000 tons per year from gas works), acetic, nitric, sulphuric and hydrochloric acids. About 3,000 tons of each of the two latter acids had to be imported in 1937. The principal plants are located near the salt deposits along the rivers Rhine and Rhone in Schweizerhall, Zurzach and Bex—also in Martigny, Uetikon and Bodio.

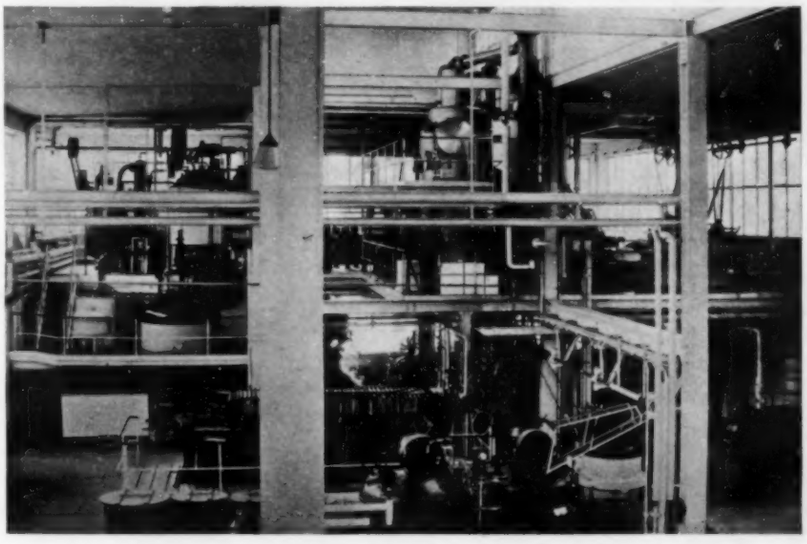
Nitric acid, calcium carbide, cyanide, acetylene derivatives, nitrophosphate and a complete fertilizer, are all made by the Lonza Co. Other electrochemical companies, located in Turgi and Mels, manufacture chlorates, perchlorates, persulphates and hydrogen peroxide.

The artificial silk industry is very active in Switzerland, producing rayon yarns, cellophane and special fibers to such an extent that over 4,000 tons were exported in 1937 valued at 21,000,000 francs. The principal plants are located in Emmenbruecke and in the Rhine Valley. They all use the viscose process with the exception of one company in Basel which produces cellulose acetate. Cellulose must be imported—8,000 tons were required in 1937. Switzerland also has a number of explosives factories, oil and paint plants, glue, fertilizer and soap plants which are sufficient to satisfy the domestic demands.

On the bank of the river Rhine at Basel, Switzerland, is the plant of the Hoffmann-La Roche Co., manufacturers of pharmaceuticals. Spacious works and modern administration buildings less than a mile from the German border are shown at top and the inside of a manufacturing unit below

Photos by Spreng S.W.B. Basel





Swiss National Exposition

At this time there is considerable interest both in Switzerland and elsewhere concerning the Swiss National Exposition which is to be held in Zurich from May to October of 1939. The chemical division of the exposition will include a presentation of chemical literature, commercial information and industrial film, exhibit of products, testing and application of dyes and industrial chemicals, demonstration of chemical and electrochemical reactions and operations and complete manufacturing processes in laboratory as well as industrial equipment.

At present there is a movement on the part of a St. Louis industrial committee headed by Gaston DuBois, vice-president of Monsanto Chemical Co., to organize privately a group of about 50 American engineers for a trip to Switzerland this summer to visit the exposition. In addition, the group plans to visit hydroelectric plants, outstanding industrial plants and the educational institutions, thereby gaining a general picture of agricultural, industrial, social and cultural aspects of the little country of Switzerland.

Charles Goodyear

INVENTOR

The year 1939 is the one-hundredth anniversary of the discovery of the process for the vulcanization of rubber. Goodyear's achievement will be celebrated in May by the American Institute of Chemical Engineers.

WEBSTER N. JONES

Director, College of Engineering
Carnegie Institute of Technology
Pittsburgh, Pa.

ONE HUNDRED YEARS ago Charles Goodyear discovered the vulcanization of rubber. To pay fitting tribute to this great inventor, the local section of the American Institute of Chemical Engineers of Akron, Ohio, the rubber metropolis, will be host to the national organization on May 15, 16, and 17, 1939. In so doing, the Institute honors the man whose experimentations were responsible for the application of one of the world's most versatile and indispensable materials. The industrial application of rubber seems to be almost limitless. We accept and enjoy thousands of comforts without giving thought to the trials and tribulations of the inventor. Little do we realize the expanse of the industry. One company takes pride in advertising that it manufactures 32,000 different products from rubber. From the basic discovery—the vulcanization of rubber—a billion dollar industry has grown in the United States.

To appreciate the development of the rubber industry, one must examine the genesis of this unique vegetable product. Articles made of rubber, the products of the crude manufacturing devices of South American Indians, were first displayed as mere curiosities in the marts of Europe. French Academicians, conducting geodetic surveys in South America, ascertained many facts concerning the milky juice that flowed from the hevea trees and the utilization of latex. No attempt at scientific study of the material appears to have been made until 1736, when LaCondamine sent a resinous mass called "caoutchouc" to the Academy of Science in Paris, together with discussions of its use by the natives for boots, water bottles, and syringes.

Many years elapsed between these first experiments with "caoutchouc" and its commercial utilization. In 1770, Joseph Priestley, the discoverer of oxygen, while experimenting with a mass of "caoutchouc" given to him by a friend, accidentally found that this substance would erase lead-pencil marks. He was so pleased that he cut the material into small pieces and gave it to his friends, calling the pieces "rubbers." This incident has the historical distinction of having given rubber its name. The next move of importance in the utilization of rubber was that of Macintosh, who dissolved rubber in turpentine and coated the cement on fabric. This material was made into raincoats, and for a century these coats have borne the name of Macintosh.

In 1800, when rubber was still no more than a curiosity, Charles Goodyear was born in New Haven, Conn. Although he spent his youth in the vicinity of Yale University, he did not attend college. He had serious intentions of entering the ministry, but was discouraged by his father, Amasa Goodyear, who needed an assistant in his trade as hardware merchant and manufacturer of farm implements. At the age of 17, Charles began an apprenticeship with a hardware firm in Philadelphia, one of the largest wholesale importing houses in the country, in order to train himself in this field. Upon the completion of his apprenticeship he entered his father's firm. This experience enabled him to develop his mechanical skill, and the realization that he was able to improve articles of necessity and convenience to man gave him great satisfaction. In 1826 he moved to Philadelphia and opened a store devoted largely to selling the products from his father's factory. This is reputed to have been the first hardware store in the United States. The firm prospered for a short time, but in 1830 A. Goodyear and Sons was forced to suspend payments, largely because of its policy of extending too-liberal credit. Charles Goodyear's health was impaired now by dyspepsia, a disease from which he suffered the remainder of his life. He was heavily in debt. Finally, in order partially to cancel his indebtedness, he disposed of the patents on farm implements and closed the business; to satisfy his creditors further, he was incarcerated in a debtor's prison.

After his release, Goodyear decided to make a profession of invention, and in a rather peculiar way, became interested in India rubber. He had stopped one day in a store in New York City owned by the Roxbury Rubber Co. and purchased a life pre-

server. Roxbury rubber goods were popular at that time. E. M. Chaffee, the foreman of a leather company, had discovered that by dissolving rubber in turpentine and adding gas black, a cement was formed which, when spread on fabric, produced an imitation leather. Capital was immediately invested in the manufacture of this cloth for shoes, boots, and clothing, and the life preserver purchased by Goodyear was one of the company's products. Several months later Goodyear returned to the store and informed the agent that he had been able to improve the inflation valve on the life preserver. The improvement turned out to be a useful one, and the agent, impressed by Goodyear's ingenuity, confided that the business was on the verge of ruin. The company had been unable to preserve its products from decay and from softening in warm weather, and a large part of the decomposed stock had been buried secretly at night to keep from the public the fact that it had become one large mass of sticky rubber!

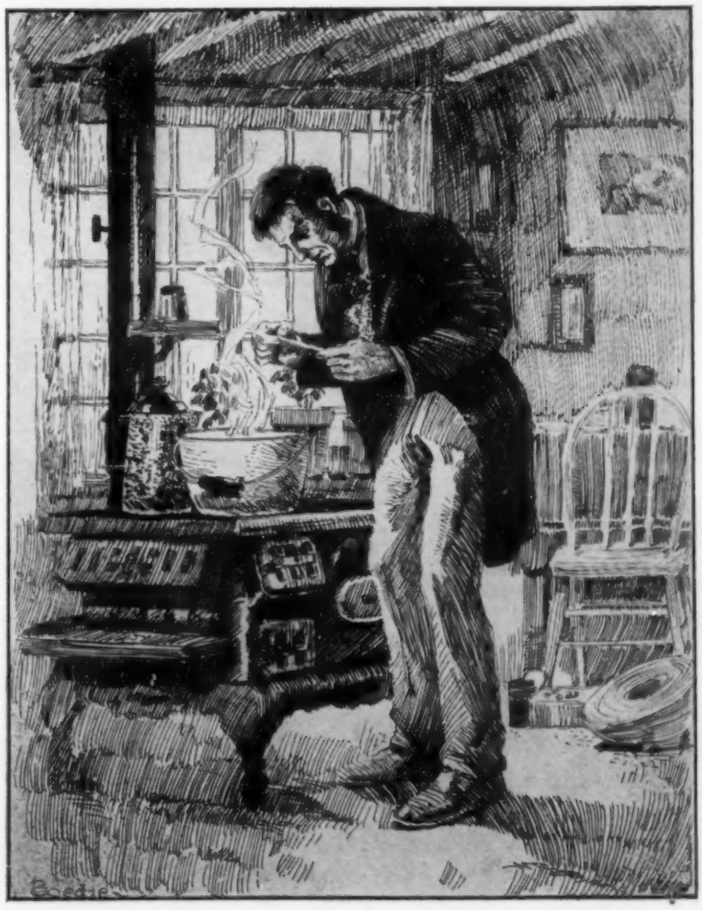
The moment Goodyear heard of these troubles, he felt called upon as by a voice from heaven to enter upon the work of redeeming this unfortunate substance from the contempt into which it had fallen. He performed thousands of experiments with such reagents as lime, magnesia, white lead, and nitric acid. A room in his house became his laboratory; the compounds were mixed by hand; and his wife's kitchen utensils were his only apparatus. What a comparison could be drawn between his laboratory and the great research laboratories of today! His first apparent success came when he blended magnesia with rubber. Heretofore all rubber compounds had been black, and a white product was a delight to his artistic nature. A friend, impressed by Goodyear's confidence that the compound would withstand heat, advanced him money to build shoes of this material. Much to their dismay, however, the shoes matted together when they were stored. The shoes made of the magnesia compound were as great a failure as were those made by the Roxbury Rubber Co.; consequently, another source of financial backing was removed.

Goodyear's frenzy increased after this failure, and he worked endlessly on his experiments. It was said of him at this time, "If you meet a man who has on an India rubber cap, stock, coat, vest and shoes, with an India rubber money purse, without a cent of money in it, that is he."

The next process upon which Goodyear based great hope was the acid gas process. This method was developed from the chance treatment of bronzed rubber drapery with nitric acid, which resulted in a partial curing of the surface. When he applied for a patent, Goodyear presented the President of the United States with a rubber calling card made in this way. Capital to begin manufacture of goods by this process was extended by William Ballard, and Goodyear's hopes rose again. However, the financial depression of 1836 and the fact that the products of the acid gas process lacked resistance to heat, caused the collapse of the company.

In 1838 Goodyear met Nathaniel Hayward, who, like himself, had long been identified with the fluctuating rubber industry. Hayward had carried on numerous experiments with rubber, and he told Goodyear of his most recent observation—that if the surface of rubber was spread over with sulphur and exposed to the sun, the rubber became more durable. Goodyear became enthusiastic about this phenomenon and the opportunity to work with a new pigment. He employed Hayward, and together they produced articles by a combination of the acid gas process and Hayward's process, which they called "solarization." Goodyear believed that he had at last achieved the perfect solution of his problem. The success of this process seemed assured; however, government mail bags, which he wisely tested before delivering, decomposed and dropped from their handles. Word of the failure of the new process soon traveled about, and once again public opinion and support, which had been turning slowly to Goodyear's favor, now swung away again and left him, penniless and ill,

In 1839 Goodyear dropped a piece of rubber mixed with sulphur on a hot stove in his home. Thus vulcanization was discovered



to renew his numerous experiments.

One memorable day in 1839, while he was talking and demonstrating to some friends in the kitchen of his home, Goodyear dropped a piece of rubber mixed with sulphur on a hot stove. The rubber charred like leather. To any one else this would have been a minor accident; to Goodyear, with his keen powers of observation, it provided the background for a new discovery. Vulcanization at last—the process which revitalized the rubber industry—presented by an impoverished inventor to a skeptical world. Of his efforts, Goodyear said, "That which is hidden and unknown and has not been discovered by scientific research will most likely be discovered by accident, if at all, and by the man who applies himself perseveringly to the subject and is most observing of everything relating thereto. This," he very properly added, "is corroborated and illustrated by the circumstances attending this discovery." It had been known that rubber would soften in the sun's rays at 100 deg. F and would be melted at a heat of 200 deg. F. "No one," said Goodyear "who had any knowledge of the nature of the gum would be likely to apply a high degree of heat to it, from design, for the purpose of divesting it of adhesiveness when it was known that it would melt at a low temperature."

It took Charles Goodyear two years to convince the long-suffering public that he had finally made the important discovery.

It was 1842 before he received the proper financial backing for his invention, and it is indicative of his character that when he was loaned $50,000 for the manufacture of vulcanized rubber, he put his two brothers in charge of the work and set about himself to continue his interesting experiments.

Goodyear's love of invention and his inability to discard experimental work and devote his energies to the manufacture of rubber goods robbed him of a great fortune but thereby enriched the world. He was involved in continual controversy with his brothers, who wished to profit from his inventions and could see no advantage in having him continue to invent articles for which there was no immediate market.

The issuance of the patent on the sulphur vulcanization of rubber to Goodyear on June 14, 1844, was the signal for instant and continuous litigation, both in the United States and abroad. Goodyear's patent rights in this country were ably defended by Daniel Webster in a celebrated case.

In 1851, the income from Goodyear's patent rights enabled him, for the first time, to visit Europe, where he hoped to further the interest in rubber products and in his own inventions. In England he placed an expensive rubber exhibit in an exposition at Crystal Palace in Hyde Park. England had refused him a patent, and he hoped, by this exhibit, to attract such public attention that a patent would be issued. The exhibit was popular, but no patent was forthcoming. He then went to Paris, was awarded manufacturing licenses but no patent, and also placed an exhibit there, at the International Exposition. This display was even more elaborate than the one given in England, and is said to have cost $50,000. The notes of French companies for patent rights, notes which Goodyear put up as security, were not paid, and Goodyear was left with a debt which he could not meet; consequently, he was placed in the Clichy jail, a debtor's prison in Paris. The Grand Medal of the Exposition and the Cross of the Legion of Honor were conferred on him while he was a prisoner. When he returned to England, he served a brief term in an English jail because of the debts incurred in connection with his exhibit there.

In 1858 Goodyear returned to the United States, broken in health but ever an experimenter. Again the bathtub in his home in Washington was converted into a pool to test life preservers, his first love. His health failed rapidly, however, and on July 1, 1860, while he was on his way to the bedside of a daughter who was critically ill, he died in New York City.

One of his many achievements was a book of two volumes, containing 620 pages, which was published in 1853. It was entitled "Gum Elastic and Its Variations," and was made entirely of rubber. The cover was richly embossed and highly polished ebonite, and the pages were thin sheets of vulcanized rubber, heavier in weight, but not thicker than, many paper books of equal pages. The book was described by Goodyear in these words: "It can be soaked six months in a pail of water and still be as good a book as ever. It can be boiled, it can be baked in an oven hot enough to cook a turkey, it can be soaked in brine, lye, camphene, turpentine, or oil; it can be dipped into oil of vitroil and still no harm done. To crown its merits, no rat, mouse, worm, or moth has even shown the slightest inclination to make its acquaintance." The original copy of this book is being preserved in the Smithsonian Institute in Washington. This important scientific contribution has recently been reproduced by the *India Rubber Journal* and is now available to the public.

The life of Charles Goodyear should be a stimulus to every one who knows of his accomplishments—the accomplishments of a man of the greatest perseverance, inspired by a frenzy to benefit mankind, and who, in doing so, ignored his own personal gain. Of his discovery of vulcanization, he said, "In now presenting it to the public, the subscriber invites the most searching investigation and the most severe trial."

Although the chance discovery of vulcanization made the rubber industry possible, the advance of the industry today is not dependent upon chance but upon cooperative research by well-trained scientists and technologists. The work that has been done and is in progress in the government and industrial laboratories is contributing to the basic knowledge of rubber and to the advance of the rubber industry. Research and development must be fostered continuously, not only by the industry itself but also by the government. Regardless of economic conditions, research should be emphasized in order to make possible the satisfaction of immediate needs, to provide for a study of the already too-long neglected basic research problems, and to insure a substitute material in case of national emergency.

Charles Goodyear has pointed the way. Let us follow his example.

Smithsonian Institute preserves Goodyear's book published in 1853. Cover is ebonite and pages are vulcanized rubber

Engineers and Business Cycles

Chemical engineers, in every walk of industrial life, are invariably affected by fluctuations in business activity. Here an attempt is made to reduce the various economic factors in the business cycle to a common denominator which is necessarily linked with engineering activity.

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THE RAPID GROWTH of the Chemical Industry has attracted so much attention that there is a tendency to regard it as virtually depression-proof. Yet, while this attitude is substantiated by production data in certain fields, a different conclusion must be reached from a study of the more mature and important chemical industries. Here, with the cessation of the original high rate of expansion, the average annual increments of growth no longer exceed the mean changes in volume resulting from cyclical fluctuations.

If one studies a series of statistics reflecting economic activity for a period of years in a certain field, there will be found in general the effects of several different factors. There will be the rather slow long-term "secular" trend of growth of the country's business as a whole. There are random occurrences, such as the greatly increased exportation of coal to England during the general strike in 1926. There is the characteristic trend of growth or decline of the industry in question. And finally there is the tendency of the industry to fluctuate for reasons of its own plus its degree of susceptibility to the generally much more important fluctuations in the business of the country as a whole.

Since this is a study of cyclical tendencies, the other factors were eliminated as far as possible. Seasonal trends were eliminated by using annual data. The long-term secular trend of business as a whole was assumed to influence all industries alike. Random trends are unavoidable and have been ignored with the hope that their influence is less great than that of other factors.

Where growth has been sustained in an industry over a long period of time, the trend can be computed. Then deviations from this trend line reflect a composite of the two main cyclical influences, namely (a) that of the industry itself, and (b) that of business as a whole. The latter predominates to such a great extent in the period under examination here that in most instances the former appears merely as a series of ripples on the surface of the characteristic cyclical wave. The nature of these ripples may be identified to some extent by comparing the year-to-year deviations from trend, plotted in graph form, for several allied industries with those of industries with different characteristics and with corresponding graphs for business as a whole.

The actual computations involve the following statistical tools*:

(a) *The Trend Line*—For this purpose the curve of best fit should be used. In the present study, however, where comparability was important, simple logarithmic trend lines, of the formula $\log y = a + bx$, were fitted by the method of least squares. The curves obtained in this way could be bettered, but, as will be seen, they fit fairly well, and they have the advantages of being comparable and objective. Also, the work sheets could be standardized throughout.

(b) *Deviations and the Standard Deviation*—Having obtained the trend line, percentage deviations between the original data and the corresponding trend ordinates are computed. To the extent that fluctuations induced by the business cycle apparently predominate those characteristic of certain individual industries, the percentage deviations from trend give a useful picture of the cyclical nature of an industry. Deviations of a stable consumption goods type of industry (such as foods) are much smaller than those of a typical durable goods industry (such as iron and steel). Going a step further, the average of all deviations for the whole period, neglecting sign, provides a rough measure of the degree of cyclicality of these industries. However, since statisticians balk at neglecting signs, a similar measure, the root mean square or Standard Deviation, is preferred. This obviates the necessity of neglecting plus and minus signs by squaring each deviation, averaging the sum of these squares, and computing the square root of this average.

(c) *Unit Deviations*—These are obtained by dividing a series of percentage deviations by the corresponding standard deviation. Since the latter is roughly representative of the degree of cyclical susceptibility, this operation in effect eliminates the amplitude of swing and thus reduces any given series of data to a basis comparable with other similarly reduced series. When the resultant reduced deviations, called Unit Deviations, are plotted against time in graph form, curves are obtained which can be compared as to their cyclical tendencies. In short, the Standard Deviation merely measures the amplitude of swing while the unit deviations graph shows the timing and extent of the swings of each series in relation to its standard deviation.

(d) *Correlation Coefficient*—Although visual comparison by superimposing one unit deviations graph upon another gives a pretty good idea of the degree of correlation between the cyclical characteristics of two industries, it is desirable to have a mathematical basis for such a comparison. This is provided by the coefficient of correlation, which is nothing more nor less than a mathematical device for measuring the degree of agreement between two series of unit deviations. It purports to tell in a single figure what would be seen in a comparison of two unit deviation graphs by superimposing one upon the other. Perfect correlation is unity, zero indicates no correlation and negative values indicate inverse correlation.

All of the six tables submitted are organized in the same manner, with two charts and a tabulation between. The chart on the left, plotted on semi-logarithmic coordinates, displays five series of data for the period 1920-1937, together

An abridged version of the paper, "The Chemical Engineer and the Business Cycle," presented before the Philadelphia meeting of the A. I. Ch. E., November 1938.

*For a discussion of these methods see: Riggleman and Frisbee, "Business Statistics," McGraw-Hill, 1938.

with a logarithmic trend line for each curve. The chart on the right, plotted on rectangular coordinates, displays the corresponding unit deviation graphs. In the table are shown the Trend Factors, Standard Deviations and Correlation Coefficients for the five featured industries, together with the same factors for such other industries as may seem to be of interest.

In the Production trend chart (see below) it is of interest to note that the logarithmic trends seem to fit the data for the widely divergent series of industries selected fairly well. When the trend has been eliminated and the unit deviations are displayed in the chart on the right, it is noteworthy how much similarity there is in the wave form of the curves for Iron and Steel, Lumber and the Federal Reserve Board Index. Petroleum Refining is not so different as one might have anticipated in view of the special problems of that industry. Slaughtering and Meat Packing, however, presents a widely divergent picture with what might be considered an excellent sample of a random trend in the years 1933-35 when drought and the Government became involved.

The story told by the charts* is confirmed by the data presented in the table, where it is seen that high correlation coefficients are obtained for the industries that appear to be in close agreement. For those industries it is believed that the standard deviation is a reliable measure of the degree of susceptibility to the influence of major fluctuations in general business such as occur in the course of the business cycle. Granting this to be the case, then it seems that regardless of trend, Steel, Automobiles, Non-Ferrous Metals, Lumber and Cement, may be considered to be four or five times as susceptible as Foods, Leather, Tobacco and Textiles. Incidentally, the close correspondence among individual members of the two groups is striking.

Since perfect correlation would be indicated by a coefficient of 1.00, it is to be noted that the correlation for the so-called heavy industries with the Federal Reserve Board Index of Industrial Production, which was used as a yardstick in this instance, is nearly perfect. Meat Packing is very low for reasons already given, while Foods and Leather, show a low but definite correlation. Petroleum Refining, Paper and Rubber show intermediate correlation and intermediate standard deviations as well.

In the trend chart of the Chemical Production table (see opposite page) it is to be noted that all trends are definitely positive and some of them very steep, indeed. The trend lines seem to be representative again, though in the case of Rayon and Non-Coal-Tar Organics there is reason to wonder if the colossal growth implied by these steep trends is being maintained. These industries can hardly continue to expand much longer at the present prodigious rates. As in the case of Petroleum, Paper and Rubber, the truly chemical industries show definite, and in some cases high, correlation with the Federal Reserve Board Index but the degree of cyclical susceptibility as measured by the standard deviation is intermediate in value. Sulphuric Acid and Sulphur exhibit both very high correlation and almost exactly the same standard deviation as the Federal Reserve Board Index, which is interesting, because for years economists have considered sulphuric acid to be an excellent barometer of business activity.

In the case of Payroll and Employment data (see opposite page) the agreement between the cyclical tendencies of the various industries as indicated by the graphs and by the correlation coefficients is even higher than in the case of production.

The fact that the standard deviations for Payrolls are in general considerably higher than those for Employment would seem to indicate a marked effort on the part of industrial managements to spread the work. Incidentally, it is noteworthy that Chemical Payrolls seem to be less than half as unstable cyclically as the durable goods industries—Iron and Steel, Automobiles, etc. In fact, they are nearly as stable as the typical consumption goods industries and slightly more stable than Textiles. It is to be observed that the Chemical data date from 1923.

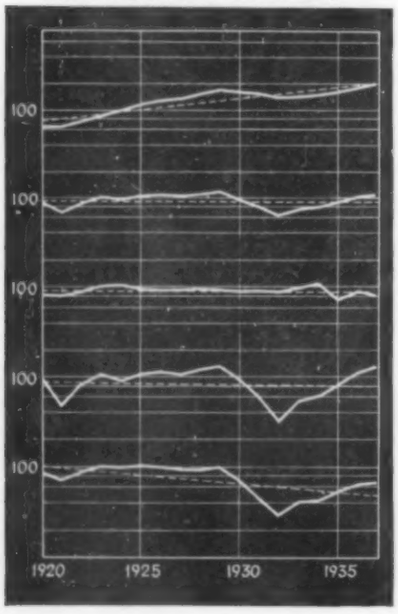
(*Text Continues on page 21*)

*T. M. Switz (see *Chem. & Met.*, Jan. 1930) reported somewhat similar trends for certain chemical and allied industries.

INDUSTRIAL PRODUCTION INDEXES

(Source: Federal Reserve Board, except as otherwise noted.)

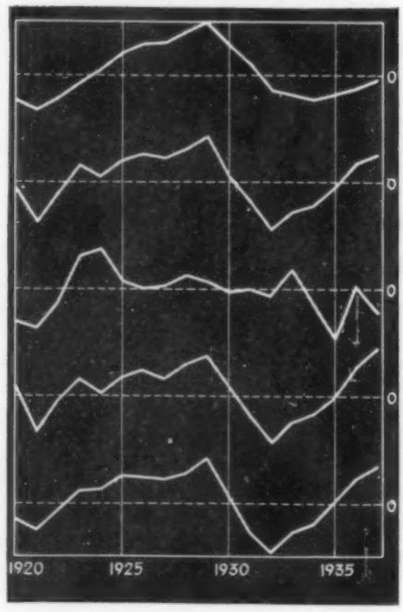
Trend [1]
(Semi-logarithmic Coordinates)



Curve	Product	Trend Factor [1]	S.D. [2]	Correl. [3] Coeff.
A.	**Petroleum refining**	1.062	15.10	0.747
	Paper production* (a)	1.026	13.00	0.873
	Rubber tires and tubes*	1.017	21.70	0.873
B.	**Industrial production, F. R. B.**	1.002	18.90	1.000
	Durable goods*	0.985	29.03	0.978
	Non-Durable Goods*	1.012	9.12	0.940
C.	**Slaughtering and meat packing**	0.999	8.99	0.131
	Foods* (b)	0.992	8.70	0.607
	Leather and products*	1.005	7.24	0.665
	Textiles*	1.006	10.05	0.849
	Tobacco*	1.003	7.61	0.891
D.	**Iron and steel production**	0.994	34.50	0.962
	Automobiles*	1.015	33.70	0.997
	Non-ferrous metals* (c)	0.995	36.50	0.944
E.	**Lumber** (d)	0.956	27.35	0.972
	Cement*	0.978	29.60	0.778

* Industries for which curves are not shown are roughly similar to those with which they are grouped.

Unit Deviations [2]
(Rectangular Coordinates)



(a) Source: American Paper and Pulp Association, Newspring Service Bureau and National Paperboard Association. Index of total paper production data, including paperboard, newsprint and fine pulp. (*Survey of Current Business.*)

(b) Source: U. S. Department of Commerce. Index of "Quantities Marketed of Animal Products and Crops." (*Survey of Current Business.*)

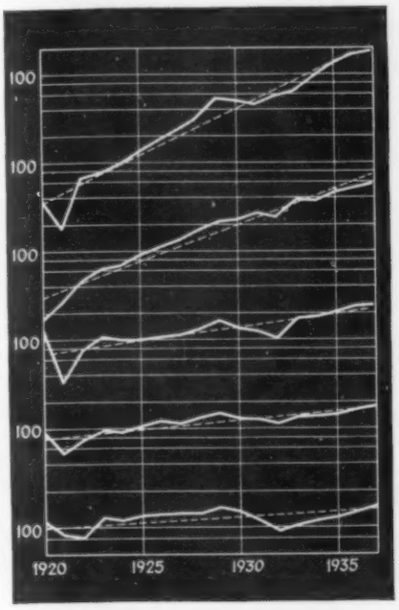
(c) Source: American Bureau of Metal Statistics, the Copper Institute and the American Zinc Institute. Composite index of copper, zinc and lead production statistics in monthly averages of short tons. (*Survey of Current Business.*)

(d) Source: National Lumber Manufacturers Association. Monthly averages of production in millions of board feet. (*Survey of Current Business.*)

(*See facing page for other footnotes*)

CHEMICAL PRODUCTION INDEXES

Trend [1] (Semi-logarithmic Coordinates)

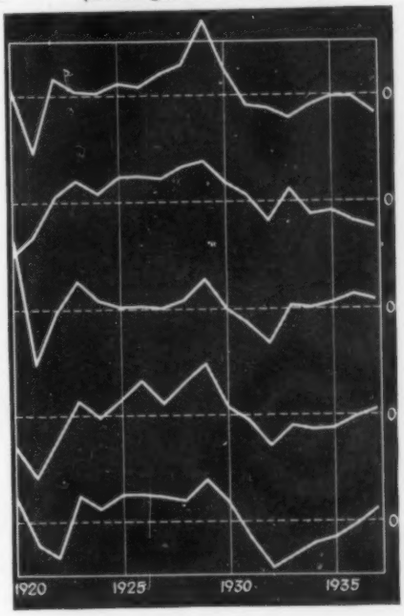


(Source: *Chem. & Met.* Review Numbers except as otherwise noted)

Curve	Product	Trend Factor [1]	S.D. [2]	Correl. [3] Coeff.
A.	**Non-coal-tar organics** (*a*)	1.277	26.1	0.723
	Industrial Production, F. R. B.*	1.002	18.9	1.000
B.	**Rayon** (*b*)	1.207	20.8	0.542
	Ethyl alcohol*	1.063	36.4	0.718
C.	**Coal-tar intermediates** (*c*)	1.071	25.7	0.525
	Coal-tar finished products* (*c*)	1.079	22.5	0.633
	Coal-tar dyes* (*c*)	1.029	17.7	0.787
D.	**Soda ash** (*d*)	1.048	14.1	0.867
	Caustic* (*e*)	1.063	14.3	0.829
	Petroleum refining* (*f*)	1.062	15.1	0.747
E.	**Sulphuric acid**	1.027	19.2	0.863
	Sulphur shipments (distribution)*	1.026	21.8	0.910

* Industries for which curves are not shown are roughly similar to those with which they are grouped.

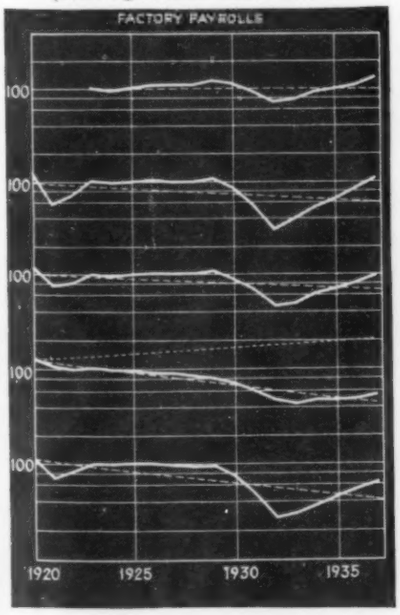
Unit Deviations [3] (Rectangular Coordinates)



(*a*) Source: U. S. Tariff Commission, Census of Dyes, except for estimates in 1920, 1930, 1931, 1932 and 1937.
(*b*) Source: Textile Economics Bureau, Inc., as published in the Rayon Organon.
(*c*) Source: U. S. Tariff Commission, Census of Dyes, except estimate for 1937.
(*d*) Soda ash produced by Solvay Process only. Production estimated for 1920, 1922, 1924, 1926, 1928, 1936 and 1937.
(*e*) Caustic production estimated for even years and 1937.
(*f*) Source: F. R. B. Index of Petroleum Refining.

FACTORY PAYROLLS AND EMPLOYMENT

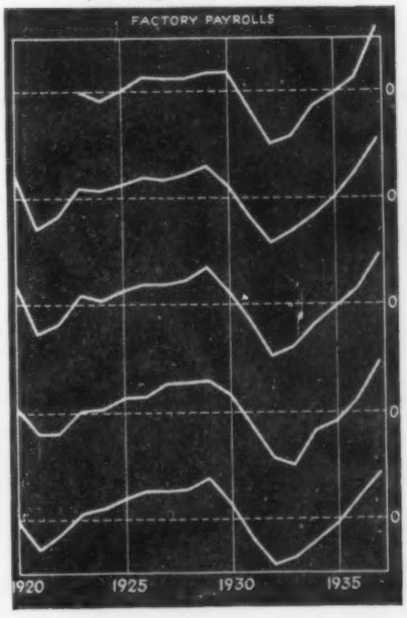
Trend [1] (Semi-logarithmic Coordinates)



(Source: Bureau of Labor Statistics)

Curve	Product	Trend Factor [1]	S.D. [2]	Correl. [3] Coeff.
A.	**Chemicals and allied products** (1923–37)			
	Payrolls	1.001	14.30	0.965
	Employment	1.023	10.00	0.562
B.	**Iron and steel**			
	Payrolls	0.973	33.73	0.986
	(*Other similar curves*)			
	Automobiles	1.000	31.77	0.903
	Industrial production, Fed. Res. Board	1.002	18.90	0.930
	Employment	0.991	16.95	0.833
	Automobiles	1.012	21.80	0.914
	Industrial production, Fed. Res. Board	1.002	18.90	0.908
C.	**Bureau of Labor Statistics Composite**			
	Payrolls	0.977	22.22	1.000
	Payrolls, basis 1923–1937	0.967	22.60	1.000
	Employment	0.984	13.84	1.000
	Employment, basis 1923–1937	0.979	14.50	1.000
D.	**Tobacco manufactures**			
	Payrolls	0.942	11.60	0.978
	Food and kindred products	1.003	10.70	0.963
	Leather	0.973	11.68	0.948
	Paper and printing	0.993	14.98	0.867
	Textiles	0.979	14.73	0.966
	Employment	0.959	4.40	0.760
	Food and kindred products	1.006	6.47	0.680
	Leather	0.995	5.77	0.780
	Paper and printing	1.000	7.04	0.880
	Textiles	0.997	6.94	0.855
E.	**Lumber and allied products**			
	Payrolls	0.944	30.37	0.974
	Employment	0.964	17.90	0.897

Unit Deviations [3] (Rectangular Coordinates)



General Footnotes for All Tables

1 Straight line trend formula:

$$\log y = a + bx$$

2 Standard Deviations (S.D.) is the "root mean square" of percentage Deviations (D) from trend:

$$S.D. = \sqrt{\frac{\Sigma D^2}{N}}$$

3 The Coefficient of Correlation (R) between two series (1 and 2) is given by the formula

$$R = \frac{\Sigma (U.D.)_1 \times (U.D.)_2}{N}$$

Unit Deviations (U.D.) are ordinary per cent deviations divided by the Standard Deviation

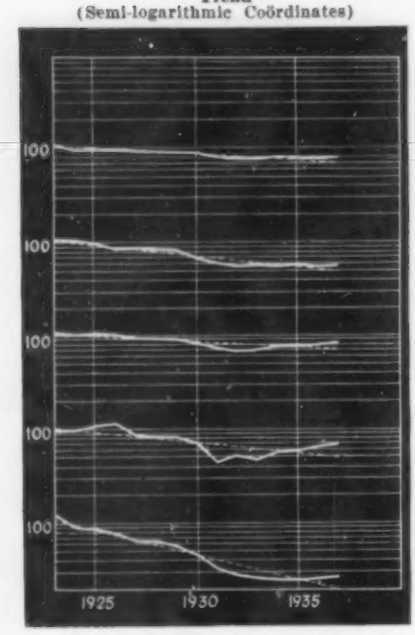
$$(U.D.) = \frac{D}{S.D.}$$

The yardstick for Correlation is the F. R. B. Index of Industrial Production or the Bureau of Labor Statistics composite.

WHOLESALE COMMODITY PRICE INDEXES

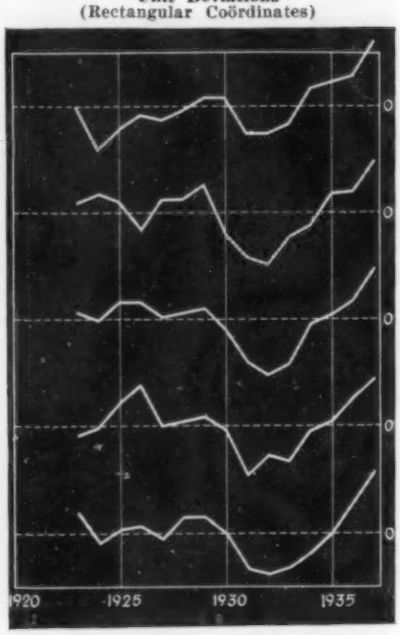
(Source: Bureau of Labor Statistics except as otherwise noted.)

Trend [1]
(Semi-logarithmic Coördinates)



Curve	Product	Trend Factor [1]	S.D. [2]	Correl. Coeff. [3]
A.	**Chem. & Met. weighted index of chemicals**	0.971	5.83	0.635
	(Other similar curves)			
	"Stabilized" chemicals [b]	1.000	3.02	0.481
	Tobacco [a]	0.997	4.36	—0.168
	B. L. S. index	0.983	5.99	0.900
	Oil, Paint & Drug Rep index of heavy chemicals	0.992	2.79	0.645
B.	**"Developmental" chemicals [b]**	0.948	7.20	0.923
	(Other similar curves)			
	Paper and pulp	0.982	7.02	0.949
	Iron and steel	0.983	7.72	0.824
	Automobiles [c]	0.963	5.92	0.730
	Oil, Paint & Drug Rep. index of coal-tar products	0.978	19.08	0.187
C.	**Composite of B. L. S. wholesale commodity prices (other than foods and farm products)**	0.977	7.65	1.000
	(Other similar curves)			
	B. L. S. index of raw materials	0.969	14.98	0.961
	B. L. S. index of semi-manufactures	0.966	12.08	0.971
	B. L. S. index of finished products	0.980	8.10	0.969
D.	**Petroleum**	0.952	19.02	0.926
	(Other similar curves)			
	Rubber tires and tubes	0.936	18.80	0.828
	Non-ferrous metals [e]	0.957	23.70	0.900
	Meat packing	0.991	21.26	0.731
E.	**Rayon** [d]	0.887	14.80	0.917
	(Other similar curves)			
	Textiles	0.962	11.50	0.964
	Lumber	0.979	13.47	0.949
	Leather	0.975	14.65	0.677
	Foods	0.978	13.15	0.844

Unit Deviations [3]
(Rectangular Coördinates)



[a] Prices, wholesale, of four leading brands of cigarettes. Source: Tobacco Manu. Assoc.

[b] See "Economic Progress and the Chemical Industry," *Ind. & Eng. Chem.* **30**, 934, 1938.

[c] Source: 1923-25 Bureau of Labor Statistics; 1925-37 "Automobile Facts and Figures" of Automobile Manufacturers Association. Index of average prices based on f.o.b. factory list price of cheapest four or five passenger closed models of each make and weighted by the relative total number of new car registrations of each make.

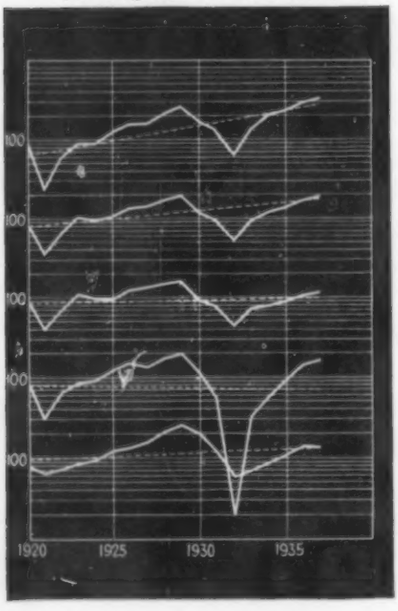
[d] Source: Survey of Current Business, U. S. Dept. of Commerce. 150 denier viscose yarn.

[e] Source: *Eng. & Min. J.* Combined index of wholesale price of electrolytic copper, N. Y., desilverized lead, N. Y., and prime Western zinc, St. Louis.

PROFITS AND PRICES PER SHARE OF COMMON STOCK

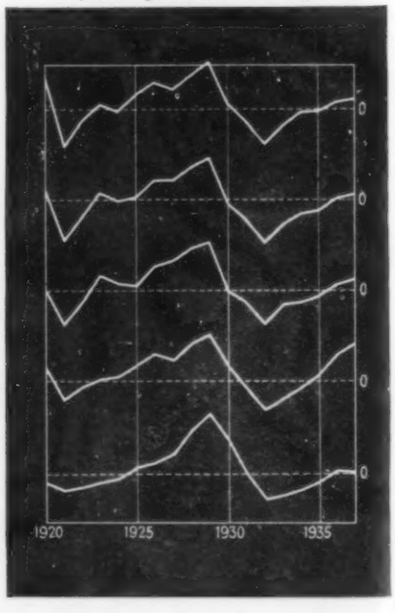
(Source: Financial Manuals—Earnings composites weighted on basis of total dollars and adjusted for stock dividends)

Trend [1]
(Semi-logarithmic Coördinates)



Curve	Company	Trend Factor [1]	S.D. [2]	Correl. [3] Coeff.
A.	**Profits of Chemical Companies, "Developmental" Group**	1.092	41.4	0.880
B.	**Profits of 14 Chemical Companies**	1.050	32.7	0.927
C.	**Profits of Chemical Companies, "Stabilized" Group**	1.010	35.5	0.907
D.	**Profits of 20 Dow-Jones Indls.**	1.007	79.4	0.894
	Representative companies:			
	American Smelting & Ref.	1.000	93.3	0.930
	Borden	0.932	49.7	0.702
	General Motors	1.107	148.5	0.814
	Liggett & Myers	1.053	20.7	0.346
	Standard Oil of New Jersey	0.987	114.2	0.832
	U. S. Steel	1.000	160.1	0.850
E.	**Prices of 30 Dow-Jones Indls.**	1.020	48.3	0.775
	Representative companies:			
	American Smelting & Ref.	1.073	54.4	0.833
	Borden	0.996	56.7	0.544
	General Motors	1.113	74.3	0.621
	Liggett & Myers "B"	1.052	25.6	0.758
	Standard Oil of New Jersey	1.020	21.6	0.714
	U. S. Steel	0.984	60.3	0.641

Unit Deviations [3]
(Rectangular Coördinates)



1 Straight line trend formula:

$$\log y = a + bx$$

2 Standard Deviation (S.D.) is the "root mean square" of percentage deviations (D) from trend:

$$S.D. = \sqrt{\frac{\Sigma D^2}{N}}$$

General Footnotes for All Tables

3 The Coefficient of Correlation (R) between two series (1 and 2) is given by the formula

$$R = \frac{\Sigma (U.D.)_1 \times (U.D.)_2}{N}$$

Unit Deviations (U.D.) are ordinary per cent deviations divided by the Standard Deviations:

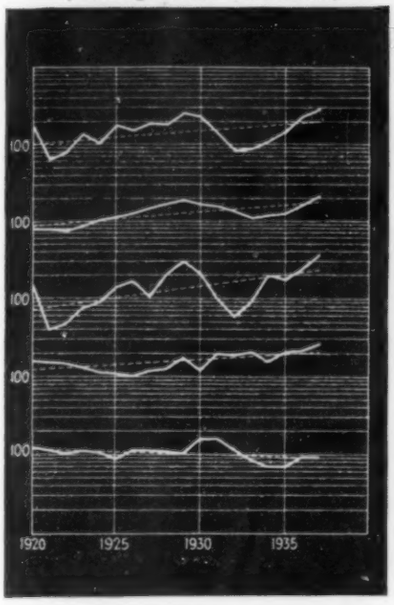
$$(U.D.) = \frac{D}{S.D.}$$

The yardstick for correlation is the Bureau of Index of Industrial Production or the Bureau of Labor Statistics composite.

MISCELLANEOUS MEASURES OF CHEMICAL ENGINEERING ACTIVITY

(Source: Confidential Reports, except as otherwise noted.)

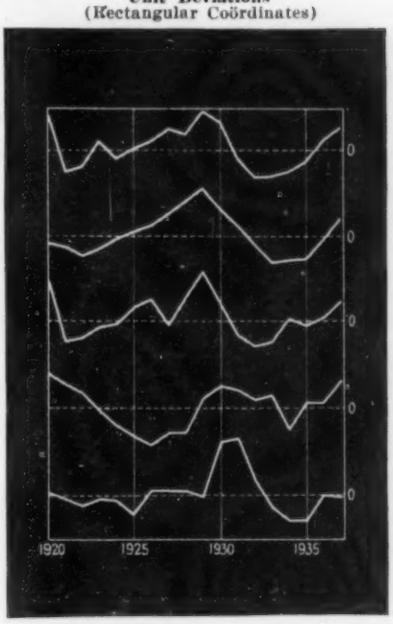
Trend [1]
(Semi-logarithmic Coördinates)



Curve	Product	Trend Factor [1]	S.D. [2]	Correl [3] Coeff.
A.	**Chemical equipment company sales — composite**	1.041	40.00	0.784
	F. R. B. index of industrial production	1.002	18.90	1.000
	F. R. B. index of durable goods	0.985	29.03	0.978
	F. R. B. index of non-durable goods	1.012	9.12	0.940
B.	**Chemical consultants sales — composite index**	1.043	22.00	0.703
	Sunspots	1.022	96.80	0.727
C.	**Chemical construction — composite index**	1.068	56.85	0.706
D.	**College enrollments***			
	Chemical engineering	1.033	18.28	−0.378
	Civil engineering	0.977	14.59	0.184
	Electrical engineering	1.000	23.72	0.451
	Mechanical engineering	1.004	13.75	−0.305
	Mining engineering	0.962	19.60	−0.323
E.	**The chemists' club bureau of employment**	0.986	23.10	0.071

*Source: Bulletins of the Society for the Promotion of Engineering Education.

Unit Deviations [3]
(Rectangular Coördinates)



The Price studies, (see opposite page) unfortunately, could not be carried back over the whole 18-year period as the residual effects of the war-time and early post-war inflation were so marked as to throw off the trends and standard deviations of the whole series. Still, the abbreviated unit deviation graphs plainly show the effect of the cyclical fluctuations in business. In general, correlation coefficients, using as a yardstick the Bureau of Labor Statistics Index of Wholesale Commodity Prices other than Foods and Farm Products, are high.

Of special interest is the relatively high downward trend in the so-called "developmental" chemicals, a group of chemicals selected from those constituting the *Chem & Met.* price index.* This downward trend considerably exceeds that of any other industry studied, with two exceptions: Rubber Tires and Tubes, as has been pointed out before, has had the advantage of a very steep decline in the cost of its principal raw material, crude rubber. The other exception, Rayon, is considered a chemical industry since the developments which made possible the price decline were largely chemical in nature.

In the Profits and Prices chart (see opposite page) it is interesting to note the close agreement between the various graphs from a cyclical point of view although there are comparatively great differences in trend. The fact that the standard deviations for Dow-Jones prices and earnings are in such disagreement is attributed to the fact that earnings can go to deficits, while price declines slow up as zero is approached. One reason is that even though earnings may be nil, common stocks still sell on asset value.

The composite curve (see above) based on sales of what is considered a representative sample of chemical equipment companies indicates a fair degree of correlation with general business activity as measured by the F. R. B. Index of Production. The degree of cyclical susceptibility reflected in the standard deviation is very high. Very similar considerations hold for chemical construction, as might be expected. While the business of a few representative chemical consultants shows only a fair degree of correlation with the F. R. B. Index, the standard deviation is low, indicating less cyclicality than might have been anticipated. This may be explained, however, by a heavy weighting of large organizations, which tend to be able to carry along a number of retainers even in bad times and can not handle all the business available at the peak of a boom.

Of special interest are the results of a rather qualitative analysis of college enrollments which show low correlation in every case and actually a small amount of negative, or inverse correlation, in several instances, including the enrollments of chemical engineers.

Additional interesting light is thrown upon this situation by the experience of The Chemists' Club Employment Bureau, where again the correlation is extremely low. The unit deviations graph, however, shows very clearly how the big mass of applications came shortly after the onset of the depression then ceased almost entirely, either because all men had registered or because those who had not registered had given up hope of obtaining work in that way.

Conclusion

After eliminating trend, the extent to which various industries fluctuate under the influence of cyclical swings in general business has been analyzed into two main components: The degree of cyclical susceptibility as measured by the standard deviation and the nature of the response as indicated by the wave form of unit deviation graphs.

The results indicate that even the newest and most rapidly growing chemical industries have much in common with the older and more mature industries. Although large annual increments of growth tend to mask the influences of the cyclical fluctuations in general business, the effects are there and become apparent when trend is eliminated.

For industries whose trend line seems satisfactory and which yield high correlation coefficients, the standard deviation serves as an interesting qualitative statistical measure of the degree of cyclical susceptibility. It seems reasonable to assume that, in this respect, industries will respond in the future as they have in the past, and consequently the data submitted in the foregoing tables provides Chemical Engineers with a basis for comparing the response of various industries to the effects of Business Cycles.

*"Chemical Industry and Economic Progress," Ind. & Eng. Chem. **30**, 934, August 1938.

Increasing "Plant" Efficiency

Hydroculture is the art of growing plants in a water solution of mineral salts instead of soil. Indications are that it may well prove an economic means of increasing the efficiency of certain kinds of agriculture and at the same time become an important new market for chemicals.

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New York, N. Y.

WHEN A SEED IS PROPERLY SOWN and nourished, it puts forth roots and leaves and becomes a plant. In fact, it becomes an extremely important chemical factory for the absorption and conversion of immense quantities of carbon dioxide into carbohydrates. From a chemical engineering point of view, we might say that the plant mines its own raw materials, builds its own factories, carries on its own processes and produces its own products. It does this with the help of man against the hazards of weather, blight, disease, and enormous competition from other plants.

Thus the growth of a plant contains all the elements of chemical engineering—except efficiency. As a producing mechanism, a plant—the fundamental basis of all earth life—is about as inefficient as anything mechanical or chemical. This inefficiency is due to many causes, some of them correctable and some not. It is the correctable causes in which we are interested here. Among these may be listed mineral deficiencies of the soil, drought, pestilence, blight, and competition from weeds.

There are a number of ways of combatting these causes, namely, fertilization, irrigation, sprays for insects and blight, and cultivation. So far these efforts have been fairly productive in that yields have been increased considerably, yet not nearly enough so because of a number of baffling limitations. Fertilization has been hampered by lack of uniformity in soil composition and considerable doubt as to the proper requirements. Mother Nature often fortifies pests with immunity to our poison sprays and renders them useless. Cultivation is an endless task because fertilization promotes weed growth and fertilization is necessary to promote crop growth.

The facts are that our entire system of converting the forces of nature to useful energy through plant growth is distressingly inefficient. For this reason any science or art that reduces these inefficiencies is indeed a welcome one.

Growers have been fighting these problems for years, and with no satisfactory answers until Gericke, a plant physiologist in California, took a simple plant laboratory technique out into his backyard and immediately produced results that need no heralding to bring them proper notice. (For a technical survey of hydroculture prior to 1931, see Miller, "Plant Physiology" McGraw-Hill Book Co.) Tomatoes, corn, potatoes, beans—all grew miraculously at his bidding. But not from the soil, for their only root nourishment was water in which certain mineral salts were dissolved.

The story of Gericke and his magic salts needs no retelling here, as it was very effectively done last summer by Frank J. Taylor (see *Saturday Evening Post*, August 20, 1938). The big point is that Gericke, starting in 1930, has produced a new method of attack on the problem of plant efficiency which immediately stepped up the control of plant growth enormously. When plants are grown in a water solution of the required mineral salts, mineral deficiencies, drought, disease born of the soil, weeds and all cultivation are eliminated. In fact, nearly all external causes of inefficiency are done away with, leaving only those of the internal plant absorbing, converting and transporting mechanisms.

Another important point to consider is that hydroculture provides a method whereby studies may be made to determine the specific mineral requirements of a plant to fertilize it for maximum production and to fertilize without waste. In short, the mining operation is performed for the plant instead of leaving it for the hit-or-miss method of plant roots.

Mineral Requirements of Plants

Heretofore, the mineral requirements of plants have been judged largely in accordance with the ash analysis of full grown healthy plants. This has proved a very profitable line of attack for it tells what the plant is taking out of the soil and hence what needs to be put back. The most exhaustive work in this field was done by Latshaw and Miller (see *Journal of Agricultural Research*, Vol. 27, p. 845, 1924) in 1924 on corn. Working in Kansas, they showed that one acre of corn in the late drought stage had taken from the soil 166.3 lb. nitrogen, 23.2 lb. phosphorus, 104.7 lb. potassium, 25.8 lb. calcium, 20.8 lb. magnesium, 19.3 lb. of sulphur, 9.7 lb. iron, 133 lb. silicon, 12.2 lb. of aluminum, 16.6 lb. chlorine, 3.7 lb. manganese, and an unanalyzed residue.

With the advent of hydroculture, however, the problem may be attacked from the standpoint of synthesis rather than analysis. That is, the mineral salt balances which will produce the maximum yield may be determined by trial. This method is more quantitative because the absorption apparatus of the roots is only partially selective. To a large degree plant roots will absorb what they find and not necessarily in the proportions best suited to their maximum growth.

Of course, agricultural schools and experiment stations throughout the country recommend a host of nutrient formulas, all of them different. The author has digested a number of these formulas and has arrived at the

values shown in Table I as being fairly representative.

One of the most consistent pieces of investigation on a nutrient formula for a specific plant has been done at the New Jersey Agricultural Experiment Station (see "Report on the Work in Progress during 1938–39," published by N.J.Agri.Exp.Sta., New Brunswick, N. J.). Working with carnations over a period of years they have developed what they consider good nutrient balance. This formula calls for

60 grams Ammonium sulphate
114 " Monobasic potassium phosphate
232 " Magnesium sulphate
975 " Calcium nitrate
1 " Ferrous sulphate
per 100 gal. of water.

While we cited above the work of Latshaw and Miller on analysis of the corn plant, the prospect for the application of hydroculture is not in a Kansas cornfield, but rather in flowers and vegetable specialties that have a relatively large money value and will so warrant the expense of installation of the hydrocultural layout. And in line with this, there is at present a considerable interest among the florists regarding the new system, simply because it eliminates so much labor in the carting and handling of compost and manure, frees them of so many hazards of pests carried in this type of material, and promises a uniformity of production results heretofore unattainable.

Table I—General Nutrient Formulas for Growing Plants From Water Solution

Formula Source	Grams of Elements per 5 Gal. of Water								
	K	Ca	Mg	Na	N*	N†	P	S	Cl
N. J. Agri. Exp. Station	1.69	3.42	1.07	...	.38	2.37	1.35	.83	...
N. J. Agri. Exp. Station	1.12	1.05	1.03	1.73	...	1.06	.99	1.34	...
N. J. Agri. Exp. Station	2.04	.92	1.03	1.73	...	1.06	1.43	1.34	...
Purdue University	6.18	.89	.49	...	1.04	2.18	1.40	1.83	...
U. S. Dept. of Agriculture	9.69	4.78	.88	...	.39	6.86	1.24	.40	.99
Boyce-Thompson Institute	1.93	1.93	1.95	...	.58	2.66	2.13	1.21	...

* Ammonia nitrogen † Nitrate nitrogen

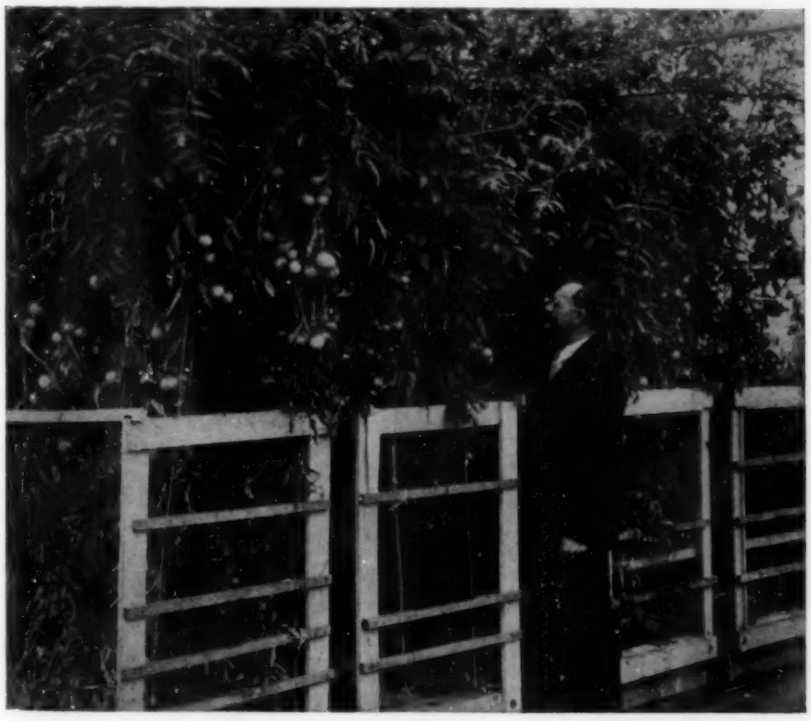
The principal stumbling blocks to their immediate adoption of the system are twofold: first, the florist is generally unversed in even the simplest chemical terminology, and second, there has been no one to date who is in a position to advise him on just what nutrient salt combination to use for this plant and which for that.

Market for Chemicals

In the field where hydroculture will first find application, the chemical market will be largely a new one. For while florists and specialty growers now use a certain amount of mineral fertilizers, they still stay pretty close to manure and compost. It can readily be appreciated that the exact size of this chemical market is predicated on a great many factors—some known, others highly conjectural. Here an attempt will be made to indicate only its probable size. In the progress report of the New Jersey Agricultural Experiment Station, referred to above, it is stated that the annual cost of chemicals to grow carnations amounted to $1 per 100 sq.ft. of bench space per year. Now there is about 200,000,000 sq.ft. of greenhouse space in the United States, and if we assume that half of this space is in regular production of flowers, and if the requirements of carnations are representative of all flowers, then the florist market is about $1,000,000.

An estimate for the vegetable field, however, is not so easy. There are no reported results. Government statistics tell us that the annual production of artichokes, cauliflower, celery, eggplant, lettuce, onions, peppers, and radishes amounts to some five million tons including an allowance for green tops and roots. As such a quantity of plant substance would contain approximately 55,000 tons of ash, i.e. mineral salts, we can conjecture for ourselves the extent of the market. Half of this requirement, estimated at an average of two cents per pound for the chemicals used runs to more than $1,000,000.

Dr. W. F. Gericke, a six-footer, looks at 5-months-old plants grown from a water solution of nutrient salts. The fruit was picked from a stepladder the following month. Flowers, fruit and vegetables all prosper by hydroculture.



Conclusion

Hydroculture at its present stage of development lacks neither a foundation of fact nor a rational economic basis on which to proceed. Its important need at the moment is a cooperative effort between growers, chemical agencies, and horticultural colleges toward a better economic and technical development of the subject.

Just now the art is suffering from a premature rash of fad interest. The sooner this is replaced by responsible technical work on the cultural requirements of the individual plants, the sooner will hydroculture find its economic niche. It is to be hoped that the next few years will see this subject receive the serious attention and development it warrants.

A New Method of Welding

With this process any commercially used thickness of steel can be automatically welded at very high speeds. Quality and low cost are among the features

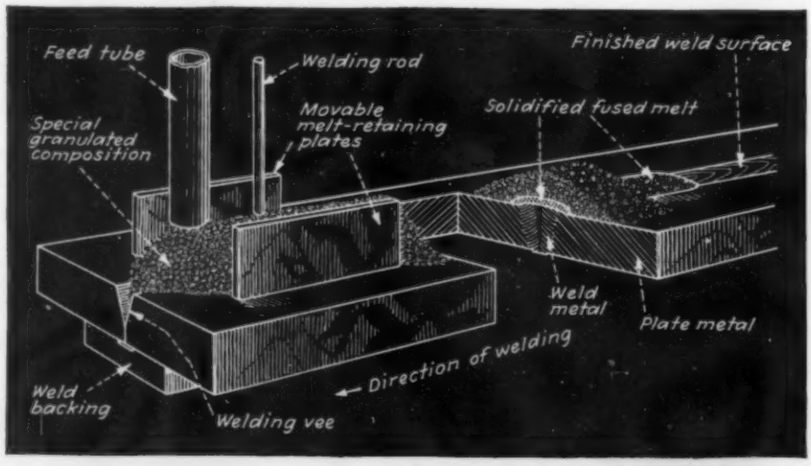
A NEW METHOD of welding pipe, tanks, pressure vessels and other process industry equipment is now available to the chemical engineer. The Unionmelt process was developed by The Linde Air Products Co. This electric process uses the heat generated by the passage of an electric current from an electrode to the work being welded. The end of the electrode is constantly covered by a highly resistant, conductive medium supplied as a special granulated material or welding composition. This material is laid down along the seam to be welded, and the entire welding action takes place beneath it, with no open, visible arc, and without sparks, spatter, smoke, or flash. Within the layer of special material, an intense, concentrated heat is generated by the electric current, and the bare metal electrode and a portion of the edges being welded are melted and fused. When a weld is being made, a sub-surface layer of the special material melts and floats as a liquid blanket over the molten weld metal.

The Unionmelt welding composition performs several important functions. It makes possible the use of higher current densities than for other welding processes. This permits the rapid generation of the intense heat which melts the metal. It is a good heat insulator and thus concentrates the heat in a relatively small welding zone. It acts as a cleanser for the weld metal. It excludes the atmosphere and other gases from the weld metal. Though the constituents of Unionmelt do not normally enter into the weld metal, special alloying elements can be introduced into the weld metal by means of this material.

The process is fully automatic. Since the granulated material is not a conductor of electricity when it is cold, a special "fuse" is used to start the weld. The fuse is covered with Unionmelt and, when the welding current is turned on the fuse becomes sufficiently hot to melt the adjacent layer of granular material, which permits the welding operation to continue.

Bare welding rod is continuously

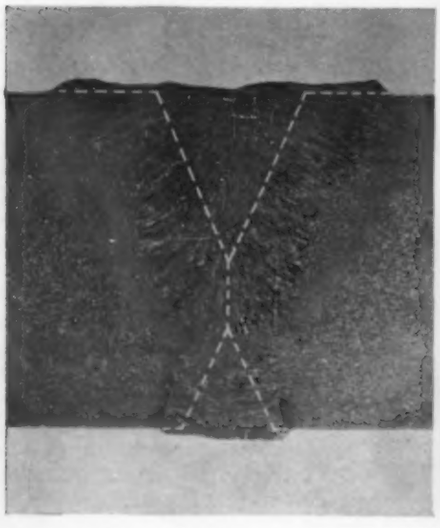
(Please turn to page 35)

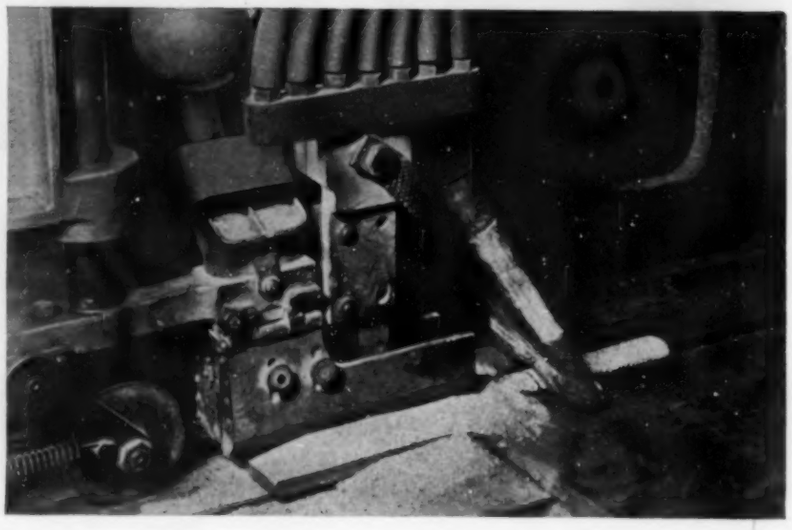


Right—How a butt weld is made

Lower left—Complete fusion obtained in two-pass butt weld in 3¼-in. plate. Smaller weld was made first. Dotted line indicates original plate edges

Lower right—The welding head is finishing a butt weld on 9/16-in. ship plate. Note appearance of finished weld at right after unfused granular material and resolidified fused melt have been removed

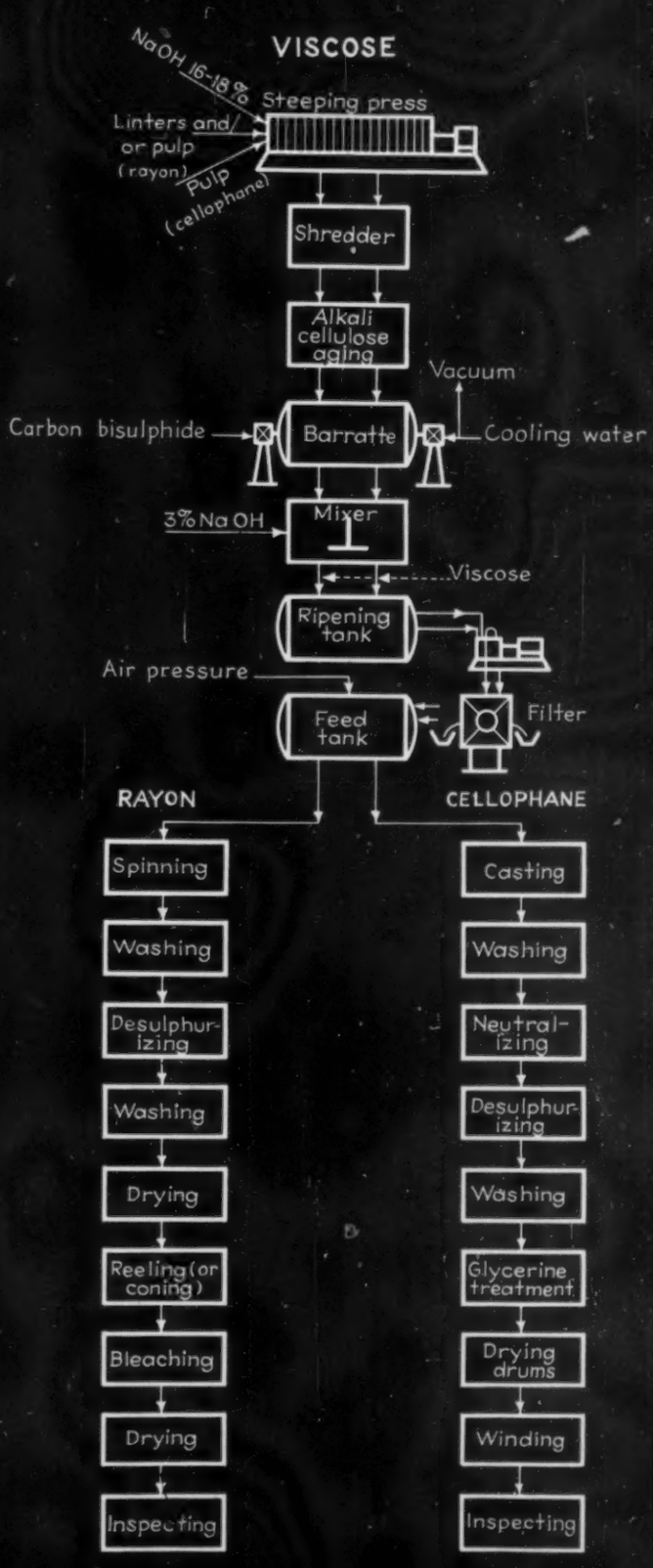




Producing Cellophane and Viscose Rayon

THE PRODUCTION of rayon has been given an important boost recently by the demand for staple fiber, and, of course, the public is forever finding new applications for the transparent wrapping material, Cellophane. One of the largest producers of these materials is the E. I. du Pont de Nemours & Co. Its plant at Richmond, Va., has been increased in size so many times that at present it covers a vast acreage and annually produces an enormous volume of both products.

Although the physical appearance and applications of viscose rayon and Cellophane are vastly different, both are made from a solution of viscose. The solution to be converted into rayon filaments is made from cotton linters and/or spruce wood pulp while that for Cellophane manufacture is made only from wood pulp. In one case the material is extruded into the coagulating bath through an orifice and in the second through a long narrow slit. Various steps in the process of preparing the viscose solution and in the processes of converting this solution into rayon yarn or transparent wrapping are illustrated by the accompanying halftones of the photographs recently taken in the Richmond plant. These are the first pictures of the Cellophane plant to be released for publication. The diagramatic flow sheet shows the principal steps in a typical process for the production of viscose rayon and cellulose film.



A Chem & Met PICTURED FLOW SHEET

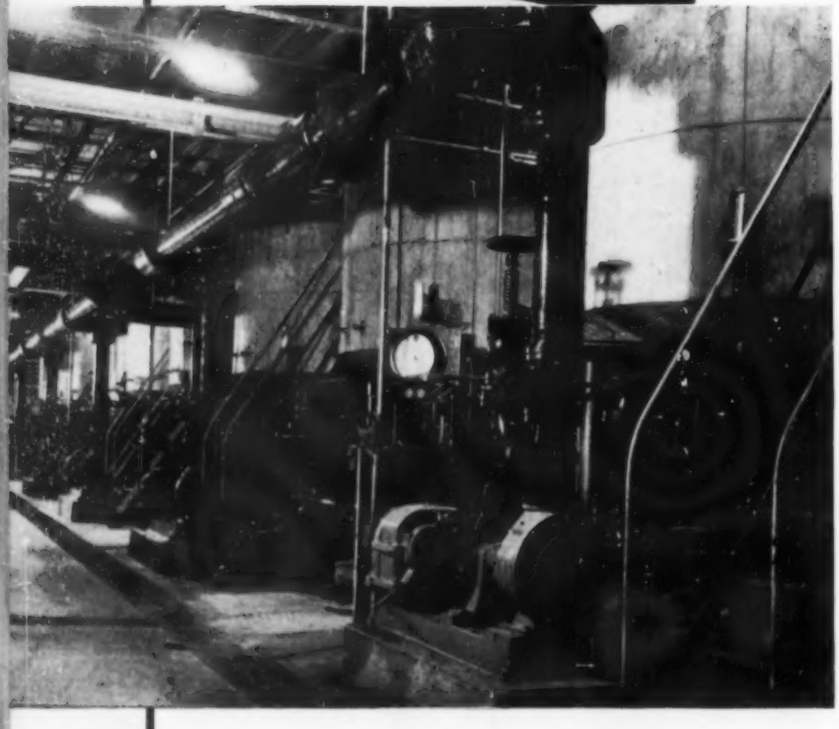


Fig. 1—Unloading a steeping press of chemically treated sheets at du Pont's Richmond, Va., plant. The treatment converts sheets into alkali cellulose, the first step in the manufacture of viscose

Fig. 2—After the sheets of cotton liners and/or wood pulp are converted into alkali cellulose they are shredded or ground in a shredding machine

Fig. 3—The alkali cellulose is treated with carbon bisulphide in the barratte. This action changes it over into xanthate. The operator is raking the mass into the conveyor box below

Fig. 4—A group of mixing tanks in which cellulose xanthate is chemically dissolved to form liquid viscose in the plant at Richmond, Va.

This group of pictures was taken in the rayon plant, but the corresponding steps in the Cellophane plant are similar in appearance.

Fig. 5—Beginning of the actual making of Cellophane cellulose film. The liquid viscose has been extruded through a long narrow slit and passed through the coagulating bath. It is seen leaving the bath

Fig. 6—A sheet of the transparent film is seen passing through heavy squeeze rolls, following washing, to remove excess water from the surface before the sheet passes on to be further dried. The cloudiness on the top of the sheet is water flowing back into the tank

Fig. 7—The finished cellulose film is being wound on large cores. The winding operation was going at full speed when the photograph was taken

Fig. 8—Rolls of the wrapping film are transferred to large drums, which are built circular like the rolls. The Cellophane is then cut to specific lengths, on order, at the Richmond plant

MAKING CELLOPHANE

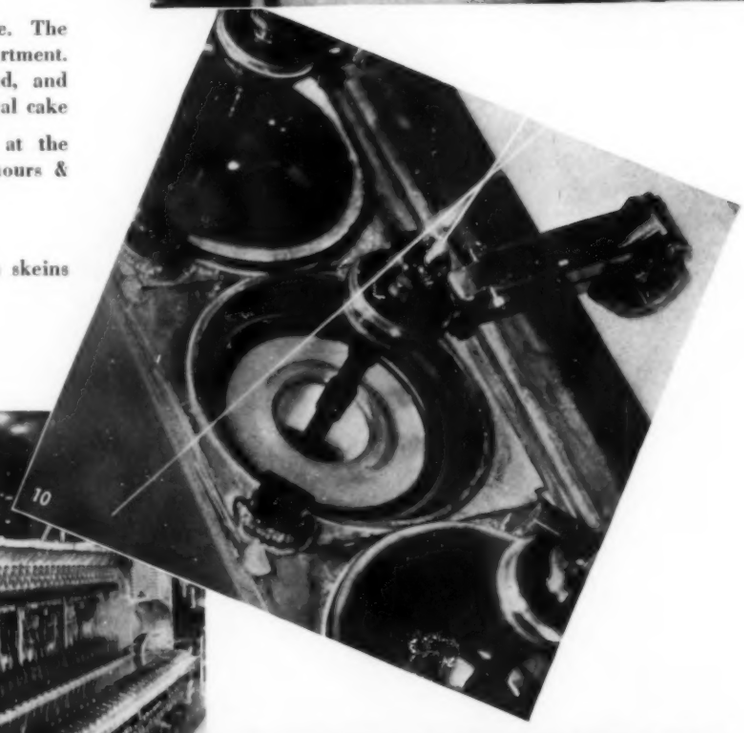
Fig. 9—Transformation of viscose liquid into a rayon thread. The blur, which was not visible to the naked eye, is the coagulation of liquid into filaments

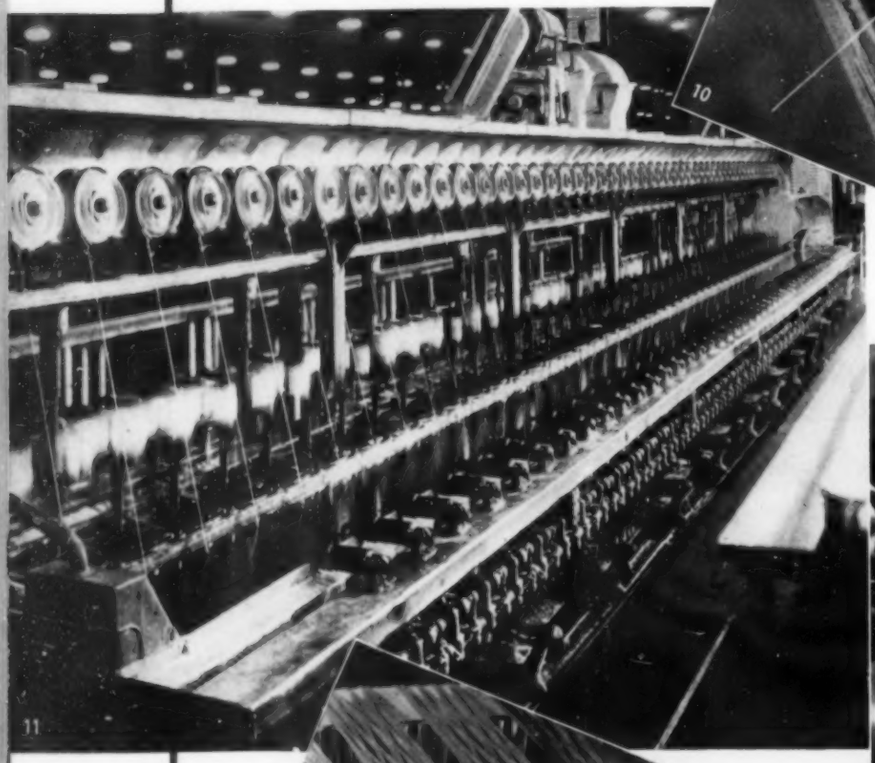
Fig. 10—A bucket in a spinning machine. The cover had been removed from the compartment. The bucket was revolving at high speed, and thread was building up as a white cylindrical cake

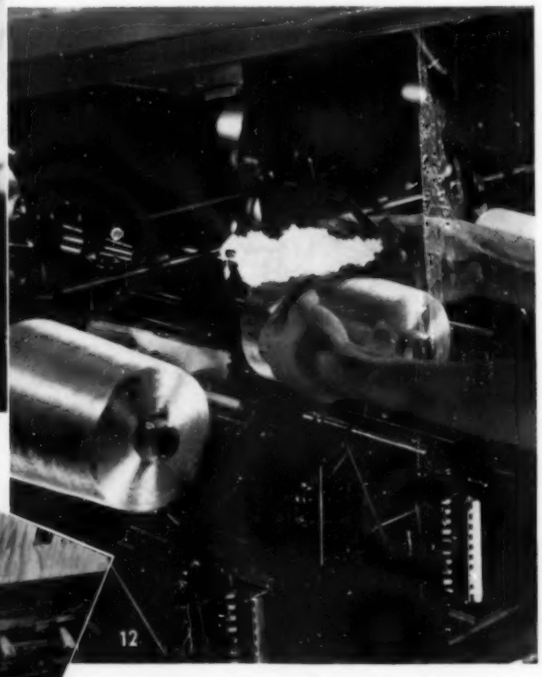
Fig. 11—One type of spinning machine at the Richmond plant of E. I. du Pont de Nemours & Co.

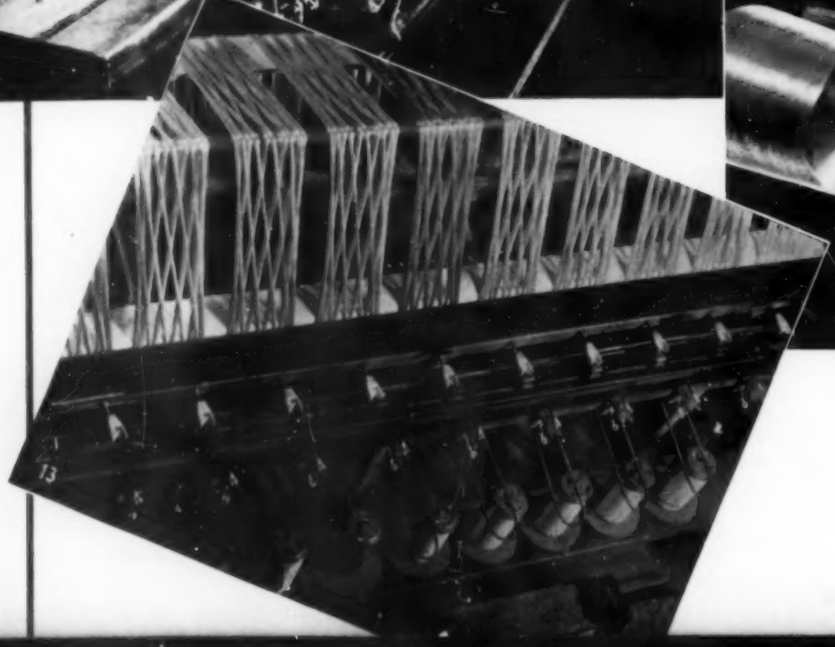
Fig. 12—Winding rayon yarn into cones

Fig. 13—Typical reeling machine on which skeins of rayon are made









Farm Products Research

To further industrial use of agricultural materials is the objective of the four regional research laboratories of the Department of Agriculture. They will be located at Peoria, New Orleans, Philadelphia and San Francisco

AGRICULTURAL MATERIALS as a basis of process industry will be investigated by the research workers of the four new Regional Research Laboratories of the Department of Agriculture. Announcement on December 14 indicated the location of these establishments at Peoria, Ill., New Orleans, La., Philadelphia suburban area, and near San Francisco, probably at Berkeley, Calif.

Two days later Dr. Henry G. Knight announced the directors of these four Laboratories which will work under Horace T. Herrick, assistant chief of the Bureau who is to have general supervision of this chemical and chemical engineering work for the entire Department. The directors named, all men of chemical experience, will be:

Orville E. May—Northern Laboratory.
D. F. J. Lynch—Southern Laboratory,
P. A. Wells—Eastern Laboratory,
T. L. Swenson—Western Laboratory.

All these men have had experience in organizing and directing research undertakings of the Department, and are well acquainted with the problems of administration under official direction. Each of these men is intimately acquainted with the projects that will be undertaken in his region, for they have been regional directors of the extended survey of present and recommended research, which has been made by the Department during the last six months.

Secretary Wallace has announced that contracts for the construction of the four principal laboratory buildings will be let as soon as plans and specifications can be made for adapting the general laboratory plan to the specific sites. It is hoped that construction will be completed during this calendar year so that research work in the scientific laboratories and the semi-works engineering divisions may be actively under way by the first of 1940.

During the period of design and construction of the buildings, the four directors will be engaged in selecting the principal members of their staff. An examination held during December by the Civil Service Commission is providing the first list of eligibles from whom these leaders will be chosen. The group for each of the four laboratories will then proceed in the detailed planning of experimental projects. Later in the year the junior members of the staff will be chosen, so that they may go to work immediately when facilities are ready for them.

The objective of the entire undertaking is to further industrial use of agricultural materials. Major emphasis will be given to food by-products and non-food uses of farm commodities. It is hoped that by such an attack some parts of the farm problem may be solved, through new knowledge from research on which practical profitable industry may be based.

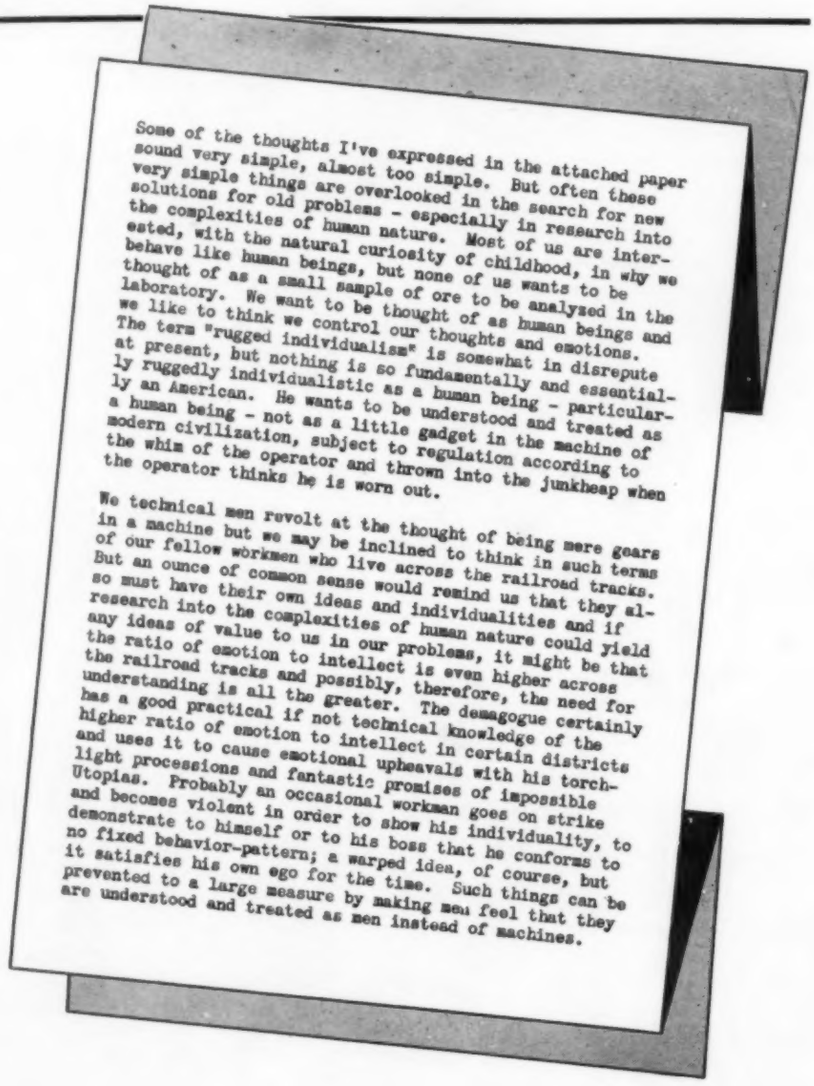
A Department committee is now engaged in working out a program for the new laboratories. This program is based largely on the results of a survey of research already under way in the four areas, and upon suggestions from a large number of scientific and industrial leaders in these areas. At each laboratory the first research projects will deal with the most important surplus commodities of the area. To begin with, the Northern Laboratory will study corn, wheat, and agricultural wastes; the Southern Laboratory cotton, sweet potatoes, and peanuts; the Eastern Laboratory tobacco, milk products, apples, potatoes, and vegetables; and the Western Laboratory wheat, potatoes, alfalfa, vegetables, and fruits other than apples.

Research on constituents common to agricultural commodities such as starch, cellulose, protein, and oil will be carried on, as well as studies looking toward the utilization of the wheat, corn and other commodities themselves.

Directors of the regional laboratories have had experience in organizing and directing research undertakings. They are: T. L. Swenson, Western Laboratory; P. A. Wells, Eastern Laboratory: Orville E. May, Northern Laboratory; D. F. J. Lynch, Southern Laboratory

Your Job . . . And Mine

Technical men, because of their unique position between management and labor, can help themselves, their bosses, and plant workers by promoting better understanding of industry's problems.


Some of the thoughts I've expressed in the attached paper sound very simple, almost too simple. But often these very simple things are overlooked in the search for new solutions for old problems - especially in research into the complexities of human nature. Most of us are interested, with the natural curiosity of childhood, in why we behave like human beings, but none of us wants to be thought of as a small sample of ore to be analysed in the laboratory. We want to be thought of as human beings and we like to think we control our thoughts and emotions. The term "rugged individualism" is somewhat in disrepute at present, but nothing is so fundamentally and essentially ruggedly individualistic as a human being - particularly an American. He wants to be understood and treated as a human being - not as a little gadget in the machine of modern civilization, subject to regulation according to the whim of the operator and thrown into the junkheap when the operator thinks he is worn out.

We technical men revolt at the thought of being mere gears in a machine but we may be inclined to think in such terms of our fellow workmen who live across the railroad tracks. But an ounce of common sense would remind us that they also must have their own ideas and individualities and if research into the complexities of human nature could yield any ideas of value to us in our problems, it might be that the ratio of emotion to intellect is even higher across the railroad tracks and possibly, therefore, the need for understanding is all the greater. The demagogue certainly has a good practical if not technical knowledge of the higher ratio of emotion to intellect in certain districts and uses it to cause emotional upheavals with his torchlight processions and fantastic promises of impossible Utopias. Probably an occasional workman goes on strike and becomes violent in order to show his individuality, to demonstrate to himself or to his boss that he conforms to no fixed behavior-pattern; a warped idea, of course, but it satisfies his own ego for the time. Such things can be prevented to a large measure by making men feel that they are understood and treated as men instead of machines.

EDITOR'S NOTE:—In transmitting this manuscript to me the author expressed some views that really belong in our editorial columns. I wonder how many other Chem. & Met. *readers feel the same way about this whole subject of public relations? Here are two paragraphs from Mr. Kimball's letter:*

IN THE GOOD OLD DAYS when a man's word was as good as his bond, a small boy gave as his definition of a friend, "A feller that knows all about ya and likes ya anyhow." In those same days 50 workers in a factory knew all about the boss who may have been both superintendent and owner and if they didn't like him, more often than not he had only himself to blame. The community also knew the factory and its people, for they were often one and the same thing. Today, with huge corporations, the owners may be thousands of small stockholders, most of them unknown to employees and management alike, and with the necessary long-distance, remote control, the organization becomes more and more like a machine and the personal element and human contacts are no longer felt.

Indeed, I have known cases of superintendents in plants remote from the executive offices who have refused to accept promotion and transfer to New York simply because they wanted to remain, in spirit at least, in the ranks of the workers from which they had graduated. Their points of view and sympathies were those of the men with whom they were in daily contact. A superintendent of a distant plant once complained to one of his rare visitors from New York that the letters from the main office were cold and inhuman and, as a little personal touch, he suggested: "If you'd only put 'go to hell' at the bottom of a letter, I'd understand—and I'd like you for it."

Why should the technical man concern himself with these matters of public and industrial relations? My answer is this: because his education

and unique position have well fitted him to make himself useful in this work. His position in the chemical process industries is that of the ham in the sandwich, between labor and management, and even in bad times, he is still necessary to make the sandwich although often sliced all too thin.

Qualified for the Job

The technical man is trained in the use of hard facts, proved laws of mathematics and of the natural sciences and sound reasoning. He deals in realities. Untried social theories, prognostications out of a crystal ball, cast of the dice, and shell-and-pea games he is quite willing to leave to the professional politician, the fortune teller or the gambler. The technical man has won the confidence of management and the former prejudices of the older plant men have largely disappeared. The technical man is in an excellent position to foster mutual understanding. He must assume his share in helping those less fortunate than himself to understand the part each plays in relation to the common interest of all, and in aiding those not directly employed in a process industry to understand the value of that industry to the community at large.

Farseeing technical men know that they must become better acquainted with industry's problems—especially those beyond the confines of their own offices. Broadminded engineers realize that if they wish to outgrow a draftsman's job of drawing tanks and kettles, they must have more than a casual acquaintance with economics and to that end they learn what they can of cost accounting. They must also be familiar with labor, raw material and the markets for finished products, with transportation facilities and costs and trends in national and world affairs. They must use their combined ingenuities to develop methods of waste disposal to prevent stream pollution, means of eliminating the nuisance of obnoxious gases and dusts in order to guard the health of the workmen and of the communities wherein plants are located. They, too, must realize that the sale of a product is not the only concern of industry, nor corrosion problems its only worry. Otherwise technical men will richly deserve the opinion held by some old-time employers and expressed by one of them in the words: "You can always hire 'em by the dozen at a $100 a month!"

Helping others to understand themselves and their relation to their fellow workers in the orderly functioning of a factory may often be one of the superintendent's most important jobs. Also it may be one of his most pleasant. But failure of a president tactfully to suggest to his office boy that he has much to learn over a long period of time and in gradual steps before he can displace him as head of the concern, may ruin a perfectly good office boy—or even a good future office manager. The executive who knows each of his employees and understands their problems, wins their confidence; who inspires his employees and instills ambition, gains their respect; who recognizes ability and rewards good workmanship always with a word and with promotion when possible, secures their loyalty.

Mutual understanding between boss and worker, personal contacts, each knowing the other as a fellow human being, is more satisfying to the average American than promises of a regimented "more abundant life" in which we all might pasture like so many contented cows—even supposing that such promises were possible of fulfillment for any but the politician. Solving the problem of the misfit, of the fellow whose only ambition is to find a job he can do well and keep on doing for life, taking the square peg out of a round hole and putting it into a square one, gives lasting satisfaction to the man and real pleasure to the skillful boss who solved his problem. That man is not the fellow who asked why the boss gets more than he does.

Be a Good Example

Manifestation of sincerity on the part of the executive and evidence of his honesty secure for him the esteem of his subordinates and these qualities become established in the unwritten code of honor for his organization. But the executive who boasts of having a parking ticket "killed" and instructs his "confidential" secretary in how to "chisel" his personal income tax or to "rig" his expense account and otherwise shows that he expects special privilege may also expect the Golden Rule of his organization to be "do others before they do you." He has no reason to be surprised when the walking delegates of the labor union accuse him of arson, murder and high treason. And why not—is honesty a matter of degree? Who could draw a very fine line of distinction between the old eastern horse-trader and the western hoss-thief?

Establishment of a fine reputation for integrity and fidelity is the first essential in any program for improvement in public relations. That once instituted and ratified by popular opinion, a program of general enlightenment can be started. This is not as simple as it sounds. Nevertheless, industry can and must take the responsibility for setting its own house in order and rededicating itself not only to doing its job well, but letting the people know about it and understand it. Technical men must accept their share of the responsibility and assist in the general program of making industry understandable. The American people must be told of the part industry plays in our country, how it benefits its employee customers as well as stockholders, how the employees of one industry are consumers of others, how industry's tax bills and the costs of strikes are ultimately paid by the consumers, whether they be stockholders, employees of industry or of government, or farmers—in other words, by the average man and woman in your job and mine.

P. B. KIMBALL
Chief Engineer
Rumford Chemical Works
Rumford, R. I.

Non-Metals in Bin Construction

This is the second of three articles in which Mr. Sandstrom draws from long experience in discussing the design of bins for chemical plant use. The first article, in December, took up metal bins. This one is concerned with concrete and wood construction, while the third will cover bins where ingenuity made up for lack of capital.

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ORDINARY CONCRETE BINS do not present any difficult design problems. But it should be borne in mind that as concrete is used in considerable volume, its weight is sometimes a large part of the total, whereas the weight of steel and wood going into construction is sometimes disregarded as being comparatively unimportant. Also, since concrete cannot be assumed to resist tension, all tensile stresses must be carried by the steel. The steel is frequently used more efficiently in concrete than in riveted plate work, however, as the loss due to lapping reinforcing bars to attain maximum bond strength is, in some cases, less than the loss in rivet holes in even a triple-riveted double-strap joint in plate work. Reinforced concrete is often cheaper than steel plate work.

As stated in the first article, bin supports are of many varieties—a few of which were shown. Occasionally a bin is supported on an elevated platform, the space beneath accommodating conveyors, or perhaps being used for storage. The floor of the bin must then be designed for transverse stresses.

In Fig. 1 is a section of one of a row of bins 30 ft. deep which, to accommodate a conveyor and spouts, were elevated as shown. The platform is supported on two walls with a clear span of 10 ft. The stored material weighs 100 lb. per cu. ft. The bin is of steel and the support, concrete.

Assuming a lateral pressure equivalent to that of a liquid weighing 25 lb. per cu. ft., an allowable stress of 16,000 lb. per sq.in. and a joint efficiency of 60 per cent, the thickness of plate at the bottom of the bin is $30 \times 20 \times 25/2 \times 12 \times 16{,}000 \times 0.60 = 0.065$ in. For practical reasons this thickness is inadequate, so we shall make the bin of ¼-in. plate at the bottom, $\frac{3}{16}$-in. at the middle and ⅛-in. at the top, its weight being about 16,000 lb. Adding the weight of the upper conveyor and runway, we have a total of about 19,000 lb. which, transmitted down the wall of the bin, makes 300 lb. per ft. of circumference.

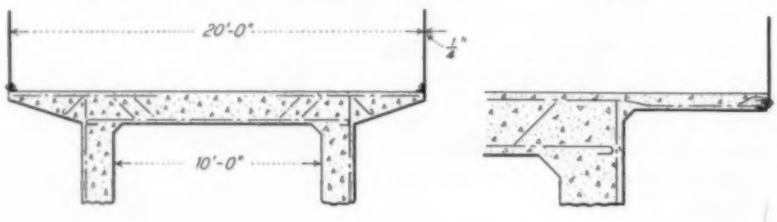
The load transmitted to the wall of the bin by friction and by the corbelling action on the angle ring at the bottom of the wall is far in excess of 300 lb. per ft. of circumference and is, in fact, a large part of the load in the bin. This load need not be considered in the design of the cantilever, however, if proper care is taken in setting the bin. If a small space is left between the angle and the cantilever, the load carried by the bin wall will be transferred around to the foundation wall, and the cantilever may be designed for only the weight of the filling above it.

When designing concrete supports for steel bins it is a natural impulse to regard the bin and its support as separate entities as shown in Fig. 1. But, as shown in Fig. 2, the bin itself can be made to carry a portion of the load of the "cantilever" around to the foundation wall, so the "cantilever" is not a cantilever at all, but a slab supported at one end on the foundation wall, and at the other on the angle ring of the bin.

In cases where the concrete floor slab conforms to the circular outline as with a single bin, proper support of the segment between the foundation walls is a somewhat difficult problem in the kind of construction of Fig. 1. In the construction of Fig. 2, however, the periphery of the segment is carried on the base ring of the bin, and so presents no difficulty.

In the earlier discussion of steel bins it was found that other considerations than strength determined the thickness of the metal: namely, corrosion and rigidity. In concrete bins, however, the theoretical amount of steel may be used and the saving applied to the cost of the concrete. Take for example the steel bin last considered. The thickness of the metal

Figs. 1 and 2—Respectively conventional concrete platform support for steel bin; and support reinforced by bin bottom angle ring



necessary to resist the stress in the lower 12 in. of the bin wall was found to be 0.0522 in. which, for a concrete bin would be provided by ⅝-in. square bars on 6¼-in. centers. Smaller bars may be used in the upper parts of the bin, their areas varying inversely as the height.

There is no definite rule governing the thickness of walls of concrete bins. Proper covering of the steel and protection from fire dictates a minimum covering of 2 in., or a total thickness of 4 in. Tall bins must have wall thicknesses at the base sufficient to carry the weight of wall above and the weight of the contents carried to it by friction, as discussed in the first article on this subject.

With poured walls as thin as 4 in., the cost of formwork is extremely high per unit volume of concrete, so recourse may be had to walls built up by plastering on the various kinds of expanded metal.

In Fig. 3 is a bag-bottom bin made of several coats of cement plaster on expanded-metal wired to steel bars. A bag-bottom bin of concrete was something of a novelty at the time that one was built, and fear was expressed about its behavior as a beam, which fear was allayed by "suspending" it from "beams" as shown: the "beams" being designed on the assumption that the bin itself did not behave as a beam but merely as a container of the filling. The main reinforcement was carried around transversely, and the metal lath applied with the ribs running longitudinally, which provided ample reinforcement in that direction.

In Fig. 4 is a cross-section of a concrete suspension bin designed as a beam. The upper edges are flanged to resist the tendency to buckle. Plastering may be done in the old manner with trowels: but better results are obtained by the impact, or compressed-air, method.

Wood Bins and Cribs

Wood, where it can be used at all, lends itself nicely to temporary work by ease of erection and a comparatively large salvage value. The principal difficulty with wood is the design of adequate connections. Weight for weight, in the direction of its grain, wood is stronger than structural steel; but in bearing across the grain, and in shear, especially along the grain, it is comparatively weak. Hence economical design in wood calls for a high degree of skill.

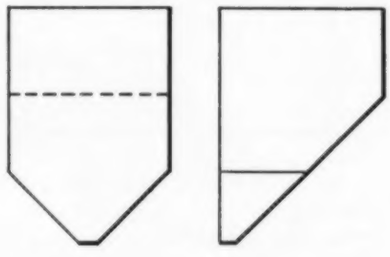
There seems to be an unwritten law that bins must have hopper bottoms. And judging by the trouble and expense involved in their construction, one might think them an actual statutory requirement. The idea back of the hopper bottom is, of course, its self-cleaning ability. But anyone who has had experience with hoppers, especially those containing fine material that occasionally becomes slightly damp, is not much impressed with their "self-cleaning" character. In fact, many hoppers with steep slopes can be found with their sides battered in from blows with sledges in efforts to start the material flowing. In many cases flat bottoms are most economical, the stored material forming an envelope of a cone through which the material flows to the spout. And should it be sometimes necessary to recover the last bit of material, it may be shovelled into the spout.

When the material refuses to flow from the bin, certain devices may be installed to induce a flow, such as stirrers, or agitators, many kinds of which will suggest themselves. Fine dry material may be started with an occasional "sniff" of compressed air, which not only dislodges the packed material, but aerates it and increases its flowability.

It has been found that a hopper with a vertical side as in Fig. 5 is less likely to cause "bridging," or packing, of the material than one with all its sides sloping to the spout—a result that probably is due to the fact that the friction between the filling and the side of the bin is less than the internal friction of the filling itself.

In Fig. 6 is a half-section of a bin used for storage of a light earthy material for which it was deemed desirable to have a hopper bottom. Because of the probable temporary nature of the project, the lining was

Fig. 5—Comparison of hopper-bottom bin types



Figs. 3 and 4—Concrete bag-bottom bins, one with beam-like supports, and one designed as a beam

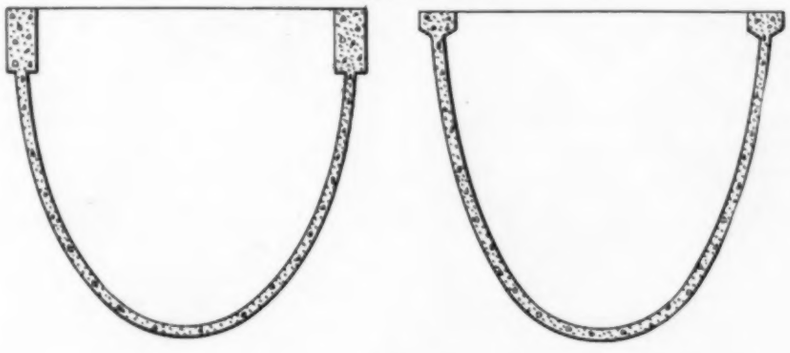
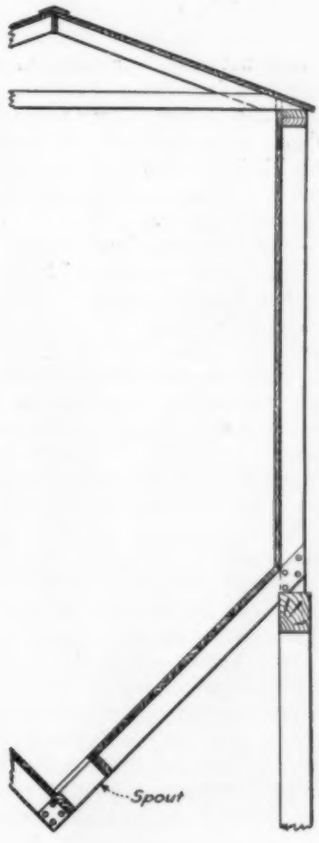


Fig. 6—Half-section of tongue-and-groove lined bin



made of tongue-and-groove flooring. Expanded metal lath and portland cement plaster would be a better lining for many kinds of filling.

Bins made of planks lapped and nailed at their ends are called "crib" bins. The lapping produces spaces between succeeding planks which gives the bin its name. Of course, such a bin is suitable for holding only coarse material, but may be made tight with filler pieces. The bottom layers are designed for the maximum pressure, and the thickness of wall (width of planks) is reduced as the pressure is reduced, to the top of the bin.

If unit widths of the wall are designed as simple beams; that is, without restraint at the ends, the bending moment formula $M = Wl/8$ applies, and the maximum moment and stress is at mid-span. By restraining the ends, the formula $M = Wl/12$ applies, and the maximum moment and stress is at the ends.

Since the moment of a restrained beam is two-thirds that of a simple beam, and since the resistance of a beam varies as the square of the depth, the required depth of a restrained beam is $\sqrt{2/3} = 0.815$, or 81.5 per cent of a simple beam.

Whether to make a serious effort to design for restraint depends on the saving possible. In the case of a crib bin the standard sizes of dressed lumber may not lend themselves to the most economical design. For example, if the filling requires a wall thickness, or depth of beam, of 11.5 in. (nominally 12 in.) when designed as a simple beam, the depth for restrained ends is $0.815 \times 11.5 = 9.375$ in., say 9.5 in. (nominally 10 in.). But if the depth as a simple beam is 5.5 in. (6 in.), the depth for restraint is $0.815 \times 5.5 = 4.48$ in., a size not readily obtainable. Designing for restraint, however, produces a rigid structure and, if obtained at not too great cost, is highly desirable, since in filling and emptying a bin the load often becomes unsymmetrical, causing racking stresses that shorten the life of the bin. Witness the bins in many rock crushing plants throughout the country, which are pictures of dilapidation.

Fig. 7 is a detail of the corners of a crib bin. The material is nominally 2×6 in. nailed at opposite corners of the laps of alternate pieces with nails that pass through two pieces and into the third, thus insuring that each piece will be held by four nails. The nails in this kind of joint, ignoring the friction between the pieces, must be designed for the resultant of the shears carried to it by the two adjacent sides of the bin. For example, if the load carried to the end of each piece is 400 lb., the resultant is $\sqrt{400^2 + 400^2} = 566$ lb., or 142 lb. for each of four nails. The specifications proposed by Dewell recommend a safe lateral resistance of 160 lb. for a 20d wire nail. The length of a 20d nail is only 4 in., so where two nails are used in each piece the penetration into the third piece is only a half inch, so in order to effectively hold 1¾-in. pieces together with four nails passing through each joint and with two nails to each piece, we must use two 30d nails which are 0.207 in. diameter and 4½ in. long, and which will enter the third piece 1 in.

The joint of Fig. 7 cannot be considered as in full restraint. Neither is it a simple support of the elements that we are calling beams; it lies between these two conditions. If assumed to be the former, it is deficient; if the latter, it errs on the side of safety. There probably are many structures which, on simple analysis, would be found balancing on the edge of failure; but which enjoy a modicum of safety by reason of partial restraint of columns and beams.

If the joint of Fig. 7 is to be designed for restraint, the nails must be of such number, size and disposition as to develop a resisting moment of $M = Wl/12$ which, for a piece of yellow pine or fir $1\frac{3}{4} \times 5\frac{1}{2}$ in., and a fiber stress of 1,200 lb. per sq. in., is $1.75 \times 5.5^2 \times 1{,}200/6 = 10{,}600$ in.lb. If the nails are 30d and are placed as in the figure, the resisting moment is only $4 \times 240 \times 2.5 = 2{,}400$ in.lb. Evidently complete restraint is impracticable in this kind of joint.

In Fig. 8*(a)* and *(b)* are corner details of a crib bin designed for rigidity. The corner pieces or braces in 8 *(a)* are $1\frac{3}{4} \times 7\frac{1}{2}$ in. (nominally 2×8 in.) with the corners sawed off as shown. The fillets in 8*(b)* are sawed from a $7\frac{1}{2} \times 7\frac{1}{2}$ in. (8×8 in. At *(c)* is an alternative arrangement, although obviously not as rigid as *(a)* and *(b)*.

In Fig. 8*(a)* is the design of the corners of a crib bin made of 2×6 in. ($1\frac{3}{4} \times 5\frac{1}{2}$ in.) yellow pine or fir. The resisting moment of a single piece with an allowable fiber stress of 1,200 lb. per sq. in. was found in the foregoing to be 10,600 in. lb. The safe load W for a span of 11 ft. is then $10{,}600 \times 12/132 = 964$ lb., and the maximum shear 482 lb. By the Dewell specifications the safe lateral resistance of a 30d nail is 240 lb., so the scheme of two nails to each piece, of such length as to pass through two

Fig. 7—Simple crib bin corner detail

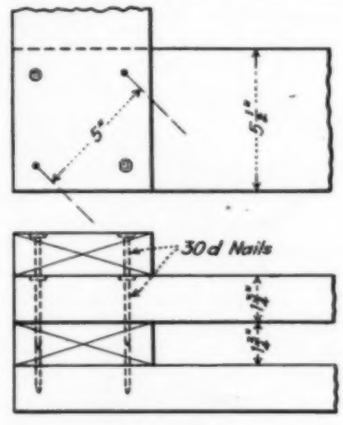
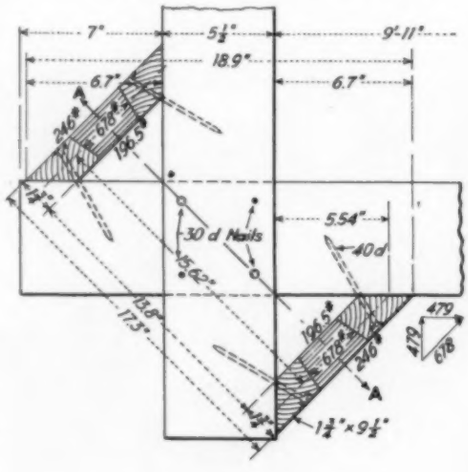


Fig. 8(a)—Analysis of crib bin corner, designed for restraint



$M = 1.75 \times 5.5^2 \times 1{,}200/6 = 10{,}600$ in.lb.
$I = 1.75(17.3^3 - 13.8^3)/12 = 373$ in.^{4}
$Z = 373/8.65 = 43.1$ in.^{3}
$f = 10{,}600/43.1 = 246$ p.s.i.
$f_1 = 6.9 \times 246/8.65 = 196.5$ p.s.i.
Avg. $= (246 + 196.5)/2 = 221.3$ p.s.i.
$P = 221.3 \times 1.75^2 = 678$ lb.
$A_m = 10{,}600/678 = 15.62$ in.
Component of P carried by friction $= 479 \times 0.40 = 192$ lb.
Component of P carried by nail $= 479 - 192 = 287$ lb.
Value of 40d nail $= 320$ lb.

$M = 1.75 \times 5.5^3 \times 1{,}200/6 = 10{,}600$ in.lb.
$I = 1.75(15.42^3 - 7.78^3)/12 = 466$ in.^{4}
$Z = 466/7.71 = 60.5$ in.^{3}
$f = 10{,}600/60.5 = 175$ p.s.i.
$f_1 = 3.89 \times 175/7.71 = 88.3$ p.s.i.
Avg. $= (175 + 88.3)/2 = 131.7$ p.s.i.
$P = 131.7 \times 1.75 \times 3.82 = 880$ lb.
$A_m = 10{,}600/880 = 12.05$ in.
Component of P carried by friction $= 622 \times 0.40 = 249$ lb.
Component carried by nails $= 622 - 249 = 373$ lb.
Value of one 50d nail = 400 lb.
Value of one 30d and one 16d nail = 368 lb.

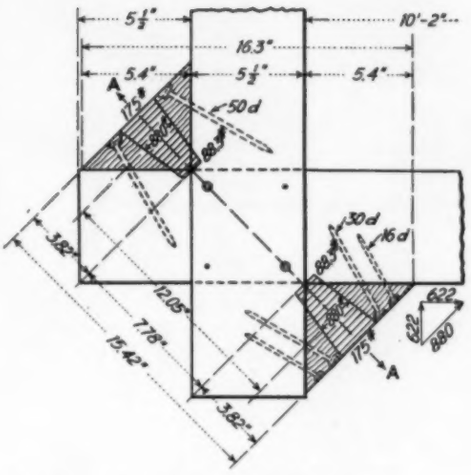


Fig. 8(b)—Analysis of another type of restrained crib bin corner

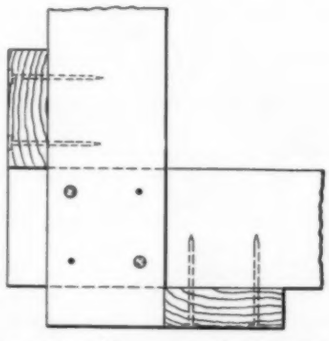


Fig. 8(c)—Alternate crib bin corner construction

pieces and into the third, will be more than enough in the present case. The effect of the nails on moment is disregarded; they are assumed to carry only shear. The shaded diagram represents the variation of pressure across the brace, and the arrow the position of the resultant. The braces are in somewhat the position of a nut in a nutcracker; but as the included angle is 90 deg., we cannot depend entirely on friction to hold them in place.

The moment of inertia I of a section A–A through the braces is 373 in.^{4}, and the section modulus Z is 43.1 in.^{3}. The maximum stress at the extremities of the section is 246 lb. per sq. in., and at the inside edges, 196.5 lb. The average stress on the section is 221.3 lb. per sq. in., from which is derived the resultant pressure of 678 lb., and the resisting moment arm of 15.62 in. The components of the force P are 479 lb., which are resisted by friction and the lateral resistance of the nails. A conservative value of the coefficient of friction is 0.40, so friction will provide for 192 lb., and a 40d nail for the remaining 287 lb.

In the arrangement of Fig. 8*(b)* the fillets are made of 6 × 6 in. sawed diagonally into two triangular pieces as shown. The moment of inertia I of the section A–A is 466 in.^{4} and its section modulus Z is 60.5 in.^{3}. The compression at the outer edge of the section is 175 lb. per sq. in., and at the inner edge, 88.3 lb. The resultant of the varying pressures is 880 lb. and its components are 622 lb. For the latter friction provides 249 lb. and the nails 373 lb.

Whether to use detail *(a)* or *(b)* is not of great moment. Detail *(a)* uses a little more wood and *(b)* a little more nail poundage. In the case of *(b)*, however, square pieces should be chosen that will permit sawing the diagonal along, or nearly along, the grain. Otherwise the nails will parallel the grain and will break out pieces of the wood and render the scheme ineffective.

When a solid wall is desired, it is customary to use filler pieces which may be only fillers, or which may be of structural importance. With the ends of alternate members restrained as in Fig. 8 *(a)*, the maximum bending moment is at the ends and any means of closing the spaces between these members will increase the strength of the span without affecting the end connections. But increasing the strength of the span moves the points of inflection closer to the supports and thus increases the capacity of the wall to resist pressure.

For narrow or shallow bins, planks may be used on edge in the manner similar to that described in the foregoing. But since these planks cannot be nailed together effectively, some means must be provided for resisting shear if it is too great for the fillets or braces already described, which are intended primarily for bending moment. The shear may be provided for by an extra fillet in the bin's vertical angle as shown in Fig. 9.

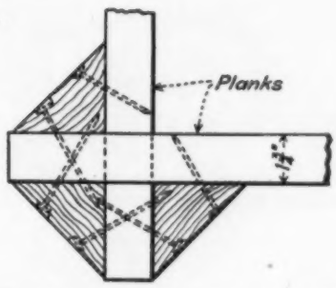


Fig. 9—Corner construction for plank-wall crib bins

(*Continued from page* 24)

fed from a special rod reel into the welding zone by the welding head. The granular material fed through the welding head is progressively laid down along the seam to be welded, a few inches in front of the rod. Since only part of the special material is fused during the welding, the unfused material is picked up, usually by a "suction cleaner," and returned to a hopper for re-use. The fused melt solidifies behind the welding zone and, on cooling, contracts and detaches itself, exposing the clean, smooth weld.

The process will make butt welds, fillet welds, and plug welds of desired practical penetration and contour in commercially used thickness of material. The method is especially advantageous where the operation is repetitive, and where welds can be made with the surface of the welding puddle approximately horizontal.

Welds can be made 20 times faster in many applications than by other applicable methods. For example, butt welds can be made at 10 to 12 in. a minute in 1-in. steel plate and at 5 to 6 in. a minute in 2-in. plate.

Any commercially available thickness of metal can be welded in one pass, with complete fusion and penetration and with any required weld reinforcement. The method has been used successfully for welding low-carbon and medium-carbon steels, stainless and many of the well known alloy steels.

Chemical Engineer's BOOKSHELF

New Titles, Foreign and Domestic

LIEBIG'S LIFE

JUSTUS VON LIEBIG. By *Richard Blunck.* Published by Wilhelm Limpert-Verlag, Berlin, Germany, 1938. 320 pages. Price, RM 7.80.

Reviewed by *Ernst Berl*

THE AUTHOR has given a clear picture of Justus Liebig's life and great performances. The personality of Liebig as one of the greatest scientists of all times has been well described. Unfortunately, no new documents are presented which would throw additional light on the development and on the performances of this great man. The author describes the life of Liebig. The best parts of his presentation are those that show Liebig's activities in the field of agricultural and physiological chemistry. The importance of research for the progress in technical fields is especially stressed.

WEALTH FROM WASTE

VERWERTUNG DES WERTLOSEN. Edited by *Claus Ungewitter* in cooperation with W. Greiling, W. Koeck and E. Barth von Wehrenalp. Published by Wilhelm Limpert-Verlag, Berlin, 1938. 304 pages.

Reviewed by *S. D. Kirkpatrick*

THAT modern Germany is looking to her chemists and engineers for the solution of some of her most pressing economic problems is evident from this interesting little volume. Its editor, Dr. Ungewitter, is the nation's outstanding authority on the economics of chemical industry. Its foreword has been written by none other than the General Field Marshall, who emphasizes the extreme importance of chemistry and technology in the German economy. Although addressed to technologists, the language and style are such that the book may be easily comprehended by the layman—in fact may serve as effective propaganda for promoting waste utilization in many industries and many countries.

After demonstrating that chemical industry has long been concerned with problems in the recovery of byproducts and the salvaging of values from wastes and used materials, this book reviews the progress in obtaining valuable materials from the air and the sea, from minerals and earths, lands and forests. Developments outside of Germany, as for example, the sea-water bromine process of Ethyl-Dow, receive attention. Finally, in a chapter headed "Das Geld liegt auf der Strasse," is a stirring appeal for all to join in a national program to conserve and develop new raw material resources from all manner of wastes. Thus the "ersatz" program of more than 20 years ago finds its present-day counterpart in a better directed effort to discover "wealth in waste."

FOR LITERATURE SEARCHERS

LIBRARY GUIDE FOR THE CHEMIST. By *Byron A. Soule.* Published by McGraw-Hill Book Co., Inc., New York, N. Y., 1938. 302 pages. Price, $2.75.

Reviewed by *Virginia Bartow*

PROFESSOR SOULE has written an exceedingly practical book which is designed to assist chemists whose training in searching for information in the chemical literature is not adequate or any others who might profit by numerous helpful and valuable suggestions. The contents of this book, which is the outgrowth of considerable experience in teaching a course in the use of chemical literature, is of inestimable value because it gives not only source material but greatly simplified directions as to how it may be used most efficiently. The advanced student or beginner in research becomes aware of the many general reference books with their somewhat mysterious keyes or summaries which must be mastered. This book, as the title indicates, guides the reader and clarifies the mass of detail to give not only directions for use but also to induce a critical evaluation of published facts which is so important in reading scientific literature.

The chapters deal with the arrangement of libraries, the sources of biographical material, the use of important periodicals and encyclopedias, the essential literature of inorganic, analytical, organic and physical chemistry and patents, patent procedure, government publications, and practical advice concerning report writing and filing of notes. Each chapter has an excellent bibliography for further reading. Although this compilation does not include every indispensable publication, it offers the reader a remarkably wide variety both of books and pertinent journal articles. It is also timely since this book is the first of its kind to be published in a decade.

There is no chapter devoted to the literature of chemical engineering. However, the technique employed in the use of the general chemical literature can be adapted in the applied fields. This guide can be recommended to students, research workers and teachers engaged in various types of chemical and chemical engineering activity.

FOOD ANALYSIS

THE CHEMICAL ANALYSIS OF FOODS AND FOOD PRODUCTS. By *Morris B. Jacobs.* Published by D. Van Nostrand Co., Inc., New York, N. Y., 1938. 537 pages. Price, $6.

Reviewed by *William L. Abramowitz*

IT IS comparatively recent that food technology and chemistry have emerged from the veiled empiricism of an art to the fairly rigid specifications of a science; and because the foundation of a chemical science rests upon analysis, books of the type of this one are of particular value. There are many hand and text books in the field of foods dealing with aspects of specialized branches as milk products, liquors, oils and fats. This new book by Jacobs may be considered as a comprehensive combination.

The subject matter includes use and identification of dyes and preservatives in foods, analysis of milk products, oils and fats, sugar foods, gums, cereals, starch and other carbohydrates, jams and jellies, spices and flavors, alcoholic and non-alcoholic beverages, meat and protein products, and vitamins.

Because of the rapid program in the field, the chapter on vitamins is somewhat behind most recent developments, but this, of course, can hardly be blamed on the author.

IRON AND STEEL

ELEMENTS OF FERROUS METALLURGY. Second Edition. By *J. L. Rosenholtz* and *J. F. Oesterle*. Published by John Wiley & Sons, Inc., New York, N. Y., 1938. 258 pages. Price, $3.

Review by *R. L. Taylor*

BRIEF, elementary, readable, this book is designed for use in a short course for engineering students not specializing in metallurgy. Considerable new and revised material has been added since the first edition.

The fact that the book is divided about evenly between iron and steel making and the metallurgy of the finished metals raises the question of whether non-metallurgists, whose principal interest in metals will be from the user's standpoint, should devote half their metallurgical training to the study of blast furnace methods and steel mill operations. If this is desirable for better understanding of the uses of metals, then the book seems excellent. This reviewer, however, feels that a little more attention could well be given to metallography, physical characteristics and metal treatment.

Aside from such debatable criticism, the book is a good piece of work. It appears to be accurate, clear, and offers non-metallurgists some background material which is not a chore to read and understand.

ORGANIC SYNTHESES. VOL. 18. Edited by *R. C. Fuson*. Published by John Wiley & Sons, Inc., New York, N. Y., 1938. 88 pages. Price, $1.75.

LITTLE that is complimentary has been left unsaid concerning these fine publications which appear periodically. They are fast providing a dependable background of organic chemical procedures, accumulatively indexed and readily available. The present volume describes the preparation, among others, of allylamine, barbituric acid, difluorobiphenyl, diphenylselenide, taurine and methylaminodiacetic acid.

PROCESS INDUSTRIES POWER

POWER REQUIREMENTS IN ELECTROCHEMICAL, ELECTROMETALLURGICAL AND ALLIED INDUSTRIES. Published and for sale by Federal Power Commission, Washington, D. C. 125 pages. Price, $1.

THIS document reports on the five-year investigation made by the chemical and electrical engineers of Federal Power Commission, initially as a part of National Power Survey. This is the first comprehensive resume which has been made available anywhere covering present practice and trends in making chemical and metallurgical products by electrothermal and electrolytic processes.

Every producer or user of such products will profitably study the statistical material and the critical text discussions which relate to aluminum, copper, zinc, magnesium, cadmium, other minor metals, ferro alloys, electric iron and steel, electric metal melting, electric heat treating, chlorine and caustic, abrasives, calcium carbide, carbon and graphitized products, and the power problems of chemical nitrogen and inorganic fertilizers.

AMERICAN MEN OF SCIENCE. Sixth Edition. Edited by *J. McKeen Cattell* and *Jacques Cattell*. Published by Science Press, New York, N. Y., 1938. 1,608 pages. Price, $12.

THE appearance of new faces on the American science front during the past few years has meant a large increase in the number of entries in this latest edition of the "blue book." The total is about 28,000 as compared with 22,000 in the last edition, published in 1933. The biographical sketches have been brought up to date in most cases and a list of names of those in the last edition who have died is appended.

RECENT BOOKS AND PAMPHLETS

The Chemical Engineering Unit Processes—Oxidation, by Donald B. Keyes, Circular No. 34, University of Illinois Engineering Experiment Station, Urbana, Ill. 50 cents. 44 pages. Covers commercial processes, equipment and calculations for the oxidation of sulphur, sulphur dioxide, ammonia, and organic compounds. 18 equipment drawings and flow sheets.

Studies in the Viscose Rayon Process, by Harold Bunger, Edward Doud and Nathan Sugarman. Bulletin No. 3, Georgia School of Technology, State Engineering Experiment Station, Atlanta, Ga. 26 pages. 50 cents. A series of 3 experimental studies: (1) The suitability of Georgia pine for the production of viscose rayon; (2) The viscosity of visvose solutions from Georgia pine pulp; (3) The effect of various acid baths on the cross-section and physical properties of viscose rayon from pine pulp. The last study contains some particularly good material on coagulating baths.

Annual Bibliography of Rubber Literature, 1937. Rubber Age, 250 West 57th St., New York, N. Y. 128 pages. Titles and locations of articles pertaining to rubber appearing in world technical literature during 1937.

Chemische Spektralanalyse, by W. Seith and K. Ruthardt. Verlag von Julius Springer, Berlin, Germany. 103 pages. 7.50 RM.

Getterstoffe und Ihre Anwendung in der Hochvakuumtechnik, by Martin Littmann. C. E. Winter'sche, Verlagshandlung, Leipzig, Germany. 103 pages. The properties and action of getters and their use in high vacuum technique.

Grade of Ore, by A. V. Corry, and O. E. Kiessling. Report No. E-6, Publication Action, Division of Information, Works Progress Administration, Washington, D. C. 114 pages. One of series of studies on mineral technology and output per man in mineral industries. Discusses trends in technology and production of gold, silver, copper, lead and zinc ores.

Trade Standards of Compressed Air Institute, Fifth Edition. Compressed Air Institute, 90 West St., New York, N. Y. 109 pages. $1.

The Preservation of Business Records. Business Historical Society, Baker Library, Soldiers' Field, Boston, Mass. 83 pages. Free. The why, what, how, and when of preserving business records.

The Risk of Unemployment and Its Effect on Unemployment Compensation, by James W. Horwitz. Business Research Studies No. 21, Harvard University, Graduate School of Business Administration, Bureau of Business Research, Soldiers' Field, Boston, Mass. 80 pages. $1.

Readings in Elementary Organic Chemistry, by L. A. Goldblatt. D. Appleton-Century Co., Inc., New York City. 150 pages. $1.25. A collection of 29 photostatic reprints of technical journal articles on applied organic chemistry. Designed to supplement textbooks in elementary organic course. Companion to similar collection on inorganic chemistry (see Chem. & Met., April 1938, p. 205).

Soil Corrosion and Pipe Line Protection, by Scott Ewing. American Gas Association, 420 Lexington Ave., New York, N. Y. 277 pages. $2.50. Information on the prevention of corrosion in underground piping systems. Material collected chiefly from available literature and presented in organized form. Covers properties of soils and piping material as they relate to soil corrosion, corrosion survey methods, coating materials and their application, and cathodic protection and electrolysis.

The Mineral Industry, 1913–1937, by G. A. Roush. McGraw-Hill Book Co., New York, N. Y. 24 pages. Free. A 25-year review of developments in the world mineral industries reprinted from "The Mineral Industry During 1937."

Directory of the Chemical Industries in Canada, 1938. Dominion Bureau of Statistics, Canadian Department of Trade and Commerce, Ottawa, Canada. 144 pages. $1. Lists producers of chemicals and allied products in Canada according to both name of producer and name of product. Gives head offices, addresses, plant locations and products made.

Universal Inventions. Universal Oil Products Co., 310 S. Michigan Ave., Chicago, Ill. 330 pages. Abstracts of more than 1,100 U. S. Patents owned by Universal Oil Products Co. as of September 1, 1938.

Priming Joinery Timber, by L. A. Jordan. Research Association of British Paint, Color and Varnish Manufacturers, Waldegrave Road, Teddington, Middlesex, England. 24 pages. 1s. 2d. Covers selection of paint, method of application, and preparation of wood.

Structural Aluminum Handbook, Second Edition. Aluminum Co. of America, Pittsburgh, Pa., 211 pages. $1.25. Since 1930 when the first edition of this handbook was published, considerable progress has been made in the manufacture and use of aluminum alloys. In this new edition the various sections have been brought up to date and a section containing commercial sizes, tolerances, and specifications of aluminum structural members has been added. Elements of sections for rectangular shapes and tubes are also included for the first time.

Standards of Heat Exchange Institute, Steam Jet Ejector and Vacuum Cooling Section. Heat Exchange Institute, 90 West St., New York, N. Y. 40 pages. $1. Covers nomenclature, performance, construction, capacities, and standard units and accessories of steam jets and vacuum refrigeration equipment. Also describes in detail the Heat Exchange Institute test code for steam jet ejectors.

Symposium on Protecting Metals Against Corrosion. American Society for Testing Materials, 260 South Broad St., Philadelphia, Pa. 50 cents.

Handbook of Industrial Fabrics, Second Edition, by George B. Haven. Wellington Sears Co., 65 Worth St., New York, N. Y. 741 pages. $2. The

excellent job done on the first edition of this book is evidenced by the fact that fourteen schools have adopted it for classroom instruction. Considerable new material is included in the present edition and an entire new chapter on logarithms, slide-rules, and nomographic charts has been added. Since there has been an extensive revision of the A.S.T.M. specifications for industrial fabrics, this section has been entirely recast.

National Fertilizer Association. Proceedings of the 14th Annual Convention held at White Sulphur Springs, W. Va., June 6, 7, and 8, 1938. National Fertilizer Association, Inc., 616 Investment Bldg., Washington, D. C. 119 pages.

Spectrochemical Abstracts, 1933-1937, by F. Twyman. Adam Hilger, Ltd., 98 St. Pancras Way, London, N. W. 1, England. 52 pages. 4s. Abstracts of over 200 papers on spectrochemical analysis.

Spectrochemical Analysis in 1938, by F. Twyman. Adam Hilger, Ltd., 98 St. Pancras Way, London, N. W. 1, England. 68 pages. 4s. 6d. A survey and discussion of the subject up to date.

Stories of American Industry, Second Series. Superintendent of Documents, Government Printing Office, Washington, D. C. 150 pages. 20 cents. A series of short radio talks broadcast over a coast to coast network during 1937 and 1938. Covers 32 different industries. Stories are of the highly popular type and tell chiefly of historical developments. Several chemical industries included.

Les Classiques de la Decouverte Scientifique. A series of publications commemorating work of outstanding members of the French Academy of Science. Published by Gauthier-Villars, Paris, France, 1938. 21 francs each volume.

Halogenes et Composes Oxygenes du Chlore. Memoirs of Scheele, Berthollet, Gay-Lussac, Davy, Balard, Courtois, Moissan and Millon. 148 pages.

La Dissolution. Memoirs of Lavoisier, Gay-Lussac, Loewel, Gernez, Lescoeur and Raoult. 148 pages.

Determination des Poids Moleculaires. Memoirs of Avogadro, Ampere, Raoult, Van't Hoff and Berthelot. 166 pages.

Les Metaux Legers—Aluminum, Glucinium, Magnesium, Metaux Alcalins. Memoirs of Deville, Heroult, Bussy, Gay-Lussac and Thenard. 166 pages.

Die Electrolytische Oxydation des Aluminiums und seiner Legierungen, by Dr. A. Jenny. Verlag von Theodor Steinkopff, Leipzig, Germany. 224 pages. Bound, 15 RM. Principles and application of the electrolytic oxidation process.

Tabellen und Vorschriften zur Quantitativen Analyse, by W. D. Treadwell. Verlagsbuchhandlung Franz Deuticke, Wien, Germany. 283 pages. 9 RM. analysis, assaying of noble metals, and gas analysis.

Evaluation of Sugar-Beet Types in Certain Sugar-Beet-Growing Districts in the United States, by A. W. Skuderna, et al. Department of Agriculture, Circular 476; 5 cents.

CORRECTIONS

New rayon reel—It has been brought to our attention that an error occurred on pages 669-70 of the article, "Viscose Rayon Spun Continuously," which appeared in our December, 1938, number. General Plastics, Inc., of North Tonawanda, N. Y., informs us that the material used in the construction of the reels of the continuous spinning machine was not Bakelite, as stated, but a special Durez plastic which was developed expressly for this purpose.

Pickle liquor—The article in the October issue entitled, "Attacking Trade Waste Problems," by G. M. Darby and C. L. Knowles contains the statement: "The Ferron process undoubtedly has advantages for treating pickling liquor but it does not as yet care for the wash water which, therefore, remains a major problem". The Allied Development Corp. has advised the authors that the original pickle liquor must be diluted with three to five parts of water according to the acid content. For this purpose wash water is usually used. Therefore, the process adequately takes care of the wash water regardless of the small amount of acid that it may contain.

R-55 Alloy—Our attention has also been called to an error in the *Chem. & Met.* Data Sheets on Materials of Construction, page 654, Nov. 1938. The chemical composition of the alloy R-55 manufactured by the La Bour Co., Elkhart, Ind., should have been shown to be Fe, 8; Cr, 23; Ni, 52; Cu, 6; Mo, 4; W, 2; Si, 4; C, 0.20. It is available only as castings.

Oxygen-free Copper—Sidney Rolle, assistant manager, The Scomet Engineering Co., Cartaret, N. J. (formerly The Oxygen-Free Copper Department of the United States Metals Refining Co.) has requested that his company be listed with those on pages 631-2, November, 1938 issue, as manufacturers of oxygen-free copper castings supplied to the trade in the forms shown in the tabulation.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from bureau responsible for its issue.

Consumption of Ferrous Scrap and Pig Iron in the United States in 1937, by Robert H. Ridgway, H. W. Davis, and M. E. Trought. Bureau of Mines, Report of Investigations 3420; mimeographed.

Consumption of Primary and Secondary Tin in the United States in 1936 and 1937, by John B. Umhau and M. E. Trought. Bureau of Mines, Report of Investigations 3418; mimeographed.

Metallurgical Developments at Mercur, Utah, by W. J. Franklin and Virgil Miller. Bureau of Mines, Technical Paper 588; 10 cents.

The Agglomerating Index of Coal, by J. F. Barkley and L. R. Burdick. Bureau of Mines, Report of Investigations 3424; mimeographed.

Coal-Mine Explosives: Their Characteristics, Selection and Safe Use, by J. E. Tiffany. Bureau of Mines, Information Circular 7040; mimeographed.

Chemical and Refining Study of Some Wyoming Black Oils, by H. M. Thorne and Walter Murphy. Bureau of Mines, Report of Investigations 3423; mimeographed.

Laboratories That Make Fire Assays, Analyses, and Tests on Ores, Minerals, and Other Inorganic Substances, by C. W. Davis and M. W. von Bernewitz. Bureau of Mines, Information Circular 6999R; mimeographed.

Annual Report of the Metallurgical Division, Fiscal Year 1937-38, by R. S. Dean and others. Detailed technical resume of major researches. Bureau of Mines, Report of Investigations 3419; mimeographed.

Flow of Air and Natural Gas Through Porous Media, by T. W. Johnson and D. B. Taliaferro. Bureau of Mines, Technical Paper 592; 10 cents.

Opium Regulations. Two new sets of regulations relating to opium, coca leaves or compounds and preparations. Regulations No. 2 (Narcotic Regulations); 10 cents. Regulations No. 5 (Narcotic-Internal Revenue Regulations); 15 cents.

Chemical Warfare Service Field Manual—Volume I. Tactics and Technique. Chemical Warfare Service, War Department; 25 cents.

Static Electricity in Nature and Industry, by Paul G. Guest. Bureau of Mines, Bulletin 368; 10 cents.

Method for Mixing Insecticidal Dusts Containing a Conditioner, by T. E. Bronson. Bureau of Entomology & Plant Quarantine, E-433; processed.

The Making and Using of Index Numbers, by Wesley C. Mitchell. Bureau of Labor Statistics, Bulletin No. 656; 20 cents.

Directional Permeability of Seasoned Woods to Water and Some Factors Which Affect It, by Harvey D. Erickson, Henry Schmitz, and R. A. Gortner. Reprint from Journal of Agricultural Research, Vol. 56, No. 10, May 15, 1938; 5 cents.

Report on Development and Use of Rayon and Other Synthetic Fibers, by C. H. Robinson, R. J. Cheatham, D. F. J. Lynch, and H. P. Holman. U. S. Department of Agriculture MC-38; processed.

Bibliography of Soil Erosion and Soil and Water Conservation. U. S. Department of Agriculture, Miscellaneous Publication 312; 60 cents.

Methods of Investigation of Surface Treatment for Corrosion Protection of Steel, by Rolla E. Pollard and Wilbur C. Porter. Bureau of Standards, Building Materials and Structures Report 8; 10 cents.

Suitability of Fiber Insulating Lath as a Plaster Base, by Lansing S. Wells and D. C. Smith. Bureau of Standards, Building Materials and Structures Report 3; 10 cents.

Regulations for the Enforcement of the Federal Food, Drug, and Cosmetic Act. Federal Register, Vol. 3, No. 251, December 28, 1938; 10 cents.

Aluminum Foil Insulation. Bureau of Standards, Letter Circular 535; mimeographed.

Unemployment and Health Insurance in Great Britain, 1911-1937, by Marianne Sakmann. Social Security Board, Bureau of Research and Statistics, Report No. 3; 10 cents.

Digest of State Laws Relating to Inheritance and Estate Taxes, 1938. Bureau of the Census; 20 cents.

The Mica Industry. U. S. Tariff Commission, Report No. 130 (Second Series); 25 cents.

Phosphate-Rock Mining, 1880-1937, by A. Porter Haskell, Jr. and O. E. Kiessling. Works Progress Administration, National Research Project, Report No. E-7. Available from Works Progress Administration, 1734 New York Ave., N. W., Washington, D. C.

Process Equipment NEWS

Machinery, Materials and Products

Inert Gas Producer

AMONG the more recent developments of the C. M. Kemp Mfg. Co., 405 East Oliver St., Baltimore, Md., is a fully automatic inert gas producer used for the production of inert gas for chemical purposes when it is necessary that the product be segregated from atmospheric air. The unit delivers from 15 to 100 per cent of its rating of 3,500 c.f.h. of a gas having an approximate analysis of 12½ per cent carbon dioxide, 0 to ½ per cent carbon monoxide, the balance nitrogen and no oxygen The water vapor content is the equivalent of saturation at 70 deg. F. If desired, units can be furnished with activated alumina dryers to discharge the gas dried to the equivalent of a −115 deg. F. dewpoint.

The unit is placed in service by operation of push-button controls and is designed for installation in hazardous locations. By incorporating this company's industrial carburetor for automatic gas and air proportioning, constant combustion analysis is said to be assured. If desired, the analysis can be automatically controlled through the use of this company's constant analysis Monitor.

New Conveyor Drive

WHAT IS claimed to be the most important improvement in recent years in driving devices for belt conveyors, has recently been announced by the Mathews Conveyor Co., Ellwood City, Pa. In the new device, the weight of the drive acts as an automatic belt tension device. It is stated to make possible at all times a minimum total belt tension, commensurate with the load being conveyed. Another advantage is that the driving mechanism can be located at any point along the length of the belt conveyor, thus affording considerable flexibility and permitting compactness in the layout. The new "floating drive" eliminates the necessity for a conventional take-up in the head- and tail-end construction and thus reduces the number of working parts. Tests are stated to indicate that 30 to 40 per cent less initial belt tension can be employed, the belt tension increasing automatically as load is added. Conveyors using the new drive may operate level, inclined or declined, or in combinations of all three. Drives are built for belt widths from 6 to 30 in., in sizes to 3 hp.

Tantalum Condenser

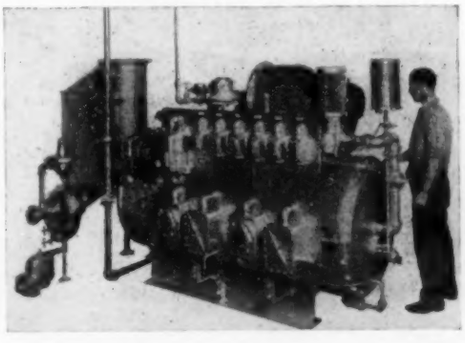
FOR ACID and other corrosive vapors and gases, particularly those containing hydrochloric or hydrobromic acid, the Fansteel Metallurgical Corp., North Chicago, Ill., has developed an efficient design of tantalum condenser, consisting of a tapered tantalum tube in a steel water jacket. The unit illustrated, which is 8 ft. high, is stated to be in operation, condensing 90 gal. of hydrochloric acid per hour under a 28-in. vacuum. The maximum inside diameter of the tantalum tube is 6 in. and the smallest diameter, 2 in., in the straight section. The tapered construction permits a large inlet diameter, yet maintains high vapor and liquid velocities in the lower part of the condenser.

The water space between the tantalum tube and the jacket is made small so that a thin film of water at high velocity removes the heat. The cooling medium is introduced through several tangential nozzles which provide flexibility in operation. Cooling water is kept in spiral motion without the use of baffles. Since the thin-walled tantalum metal does not scale, high heat transfer rates are obtained. For example, with a temperature rise of 35 deg. F., condensate is stated to be removed at a temperature within 5 or 6 deg. of the entering cooling water.

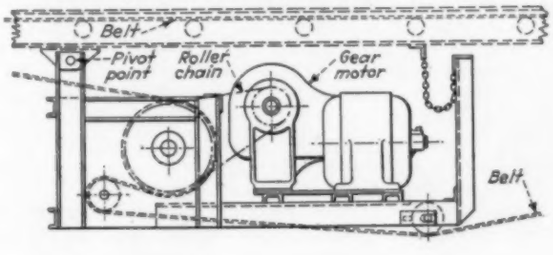
Fan Operated Burner

SIZES from 10 to 100 hp. are available in a new motorized fan gas burner assembly for all kinds of fuel gases, recently developed by Lee B. Mettler Co., 406 South Main St., Los Angeles, Calif. The new "Fan-Air" burner has been designed as a companion to this company's natural draft conversion unit and embodies the company's entrained-combustion principles. The motorized fan provides 100 per cent of the combustion air, requiring no secondary air and thus relieving the stack of all but ventilation duty. Thus, it is claimed, correct air-balance is obtained under all circumstances. The new burner is stated to burn all gases at all pressures in any

Automatic inert gas producer



Arrangement of new floating conveyor drive



High capacity tantalum condenser

type of heat exchanger and to be capable of limited operation with natural draft when desired. The burner is adjustable for either incandescent, flameless or long-flame combustion.

Equipment Briefs

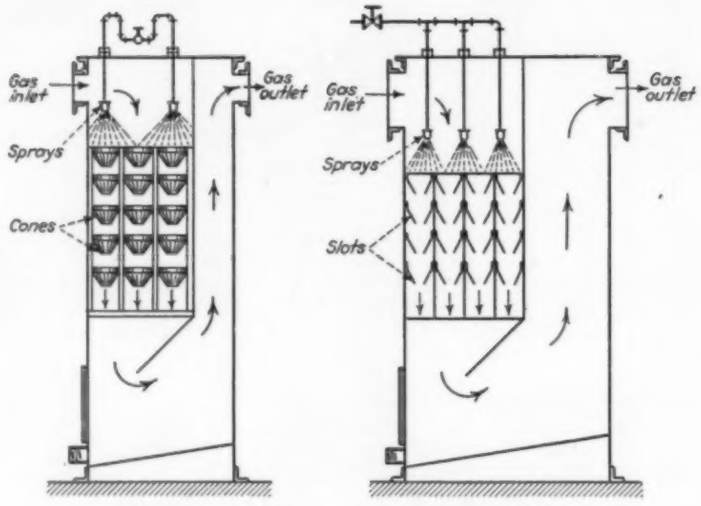
SEVERAL IMPROVEMENTS in its high-duty magnetic pulleys have recently been announced by the Stearns Magnetic Mfg. Co., Milwaukee, Wis. A new ribbed construction is employed which permits the use of deeper coil pockets so as to allow for more copper wire and more ampere turns, thus giving greater magnetic strength. Improvements in the system of air-cooling ducts have also been included. The windings are completely surrounded by steel and fully protected against external hazards. Completely weather-proofed construction is said to have been employed.

THE LATEST lift truck put out by the Lewis-Shepard Co., 245 Walnut St., Watertown, Mass., is a foot lift truck operating on the hydraulic principle. Lifting is accomplished by means of a foot pedal which requires no head or side room. Exceptionally high lift is provided. The release control is of the variable speed type, so designed that if the operator takes his hand from the control, downward movement of the platform automatically stops. Standard capacities range from 3,500 to 8,000 lb., with a 3-in. lift. Optionally, lifts may be obtained as high as 7 in. Anti-friction bearings are standard equipment.

TO PROVIDE an explosion-proof lighting fixture for locations in which it is not possible to mount the lighting units overhead, the Benjamin Electric Mfg. Co., Des Plaines, Ill., has designed a series of angle-bracket-type explosion-proof fixtures, suitable for side wall mounting. These units are listed as explosion-proof fixtures for Class I, Groups C and D locations, by the Underwriters' Laboratories. Service in atmospheres containing solvents and petroleum products is acceptable. The design is of the type which prevents explosions originating within the fixture from escaping to the surrounding flammable atmosphere.

A RECENT INTRODUCTION into the United States, after ten years of use in several European countries, is a colloidal boiler compound, K.A.T., which has been put on the market by the American K.A.T. Corp., 122 East 42d St., New York, N. Y. The material is an organic vegetable emulsion of fully colloidal nature, containing linseed and other organic substances Used within the boiler, the colloids coat the impurities and keep them separated, thus preventing crystallization and deposition as scale. Furthermore, it is stated that K.A.T. will remove scale already present, that it will remain completely unchanged at highest operating pressures and temperatures and that it has no oil content. It is claimed as a universal compound, operating successfully under widely varying water conditions, and at the same time giving protection in the boiler against corrosion and embrittlement.

COMPLETE SAFETY is the outstanding reason for the recent development by the Eclipse Air Brush Co., 390 Park Ave., Newark, N. J., of a new air-motor operated agitator, known as the Pneumix Type B. The new agitator, built for handling batches up to 100 gal., is, of course, completely spark-proof and cannot heat. Its speed is variable from 30 to 6,000 r.p.m., requiring 5 to 50 lb. air pressure. Quiet operation is provided by the use of an exhaust muffler. Two propellers are mounted on the shaft, arranged to "throw" toward each other, so as to prevent splashing. Chromium plate, stainless steel or bronze, are regularly available for submerged parts although other metals can be supplied to order.



Side elevations of cone and slot type scrubbers

Orifice Gas Scrubbers

AT THE RECENT Metals Mining Convention and Exposition held in Los Angeles, Western Precipitation Corp., 1016 West 9th St., Los Angeles, Calif., exhibited two variations of a new type of orifice gas scrubber, a cone type and a slot type. It was pointed out that the cone-type is more efficient than the less expensive slot type. This development followed an investigation of all the usual type of scrubbers and culminated in the new constructions, both of which are said to have higher efficiency than other scrubbers in common use. Best results are said to be obtained in the cone type with 2–3 in. orifices, and in the slot type, with 1–2 in. Both types are built in unit assemblies for flexibility in capacity and are available in sizes ranging from 700 to 17,500 c.f.m. at a pressure drop of 4 in. w.g. In both types gas flows concurrent with the water spray. Water pressure to the sprays is 30–50 lb. per sq.in. and the water may be recirculated if the scrubber is used in conjunction with a settling tank. Pressure drop across scrubbers of this type varies from 2 to 6 in. w.g., with higher efficiency at the higher pressure differentials.

Cathodic Protection Rectifier

TO COUNTERACT and practically eliminate galvanic action or electrolysis on underground pipe lines, a copper oxide rectifier developed for cathodic protection has been announced by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. The rectifier consists of the necessary Rectox units, having a rating range from 3 to 50 volts and 1 to 125 amp. d.-c. output. These are combined with a two-winding transformer, a disconnect switch and a terminal board, all mounted in a sheet steel ventilated cabinet designed for either outdoor or indoor use, as desired. How much current and voltage is needed for protection in a given case can be found only by actual trial. Usually it is found that if the pipe can be maintained negative to the earth by 0.3 volts or more, corrosion will be stopped.

The new rectifiers are stated to require no maintenance and no attention beyond occasional check of output, which is required owing to seasonal variation in soil and coating resistivity.

Magnetic Switch

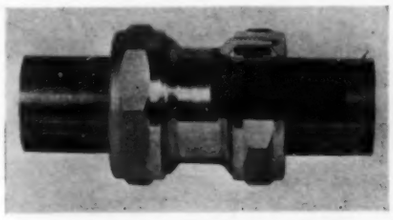
CONSIDERABLE decrease in size as compared with earlier a.-c. magnetic switches has been accomplished by the General Electric Co., Schenectady, N. Y., in the design of the new CR 7006-D51, a.-c. magnetic switch for full voltage starting of single-, two- and three-phase motors.

In addition to its small physical dimensions, the switch features conservative electrical design, long mechanical life and low maintenance cost, according to the manufacturer. Basically, the switch consists of a line contactor, with interlock to provide under-voltage protection, and two isothermic temperature overload relays to protect the motor against overheating. The open-type switch is furnished with a rigid mounting plate to permit easy mounting on either an insulating or a conducting panel. The temperature overload relay can be set for either hand-reset or automatic reset.

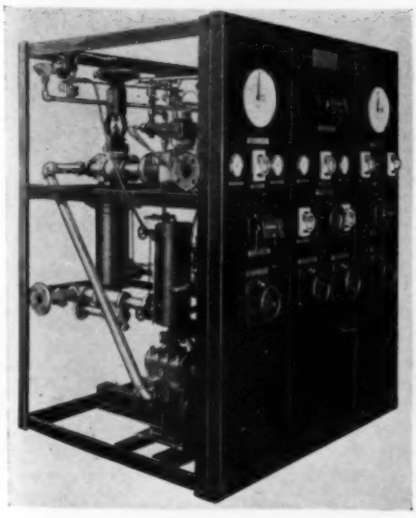
Improved Type Coupling

ANNOUNCEMENT has been made of the recent appointment of the Pittsburgh Equitable Meter Co., Pittsburgh, Pa., as sole distributor for the Raybould couplings and fittings, manufactured by the Raybould Coupling Co., Meadville, Pa. This coupling, one type of which is illustrated in cross section herewith, is made in both screwed and flanged types, and is said to furnish a simple and leakproof method of joining plain end pipes. It consists of two resilient compression rings, metal bushed at either end, encased in two flanges or follower rings which bear against a center ring acting as a spacer between the flanges. The compression rings provide the sealing medium, while the flanges sustain all mechanical forces applied in tightening the couplings. In sizes smaller than 3 in., compression nuts replace the flanges and the coupling is fastened, as shown in the illustration, by tightening the nuts on a threaded center ring.

Screwed type Raybould coupling



Side view of cubicle type Proportioneer



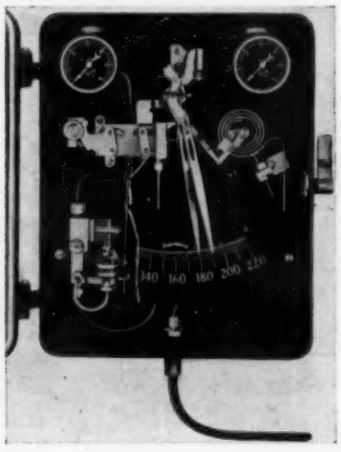
Cubicle Type Proportioner

IN LINE with the trend toward unit assemblies, Proportioneers, Inc., 9 Codding St., Providence, R. I., has announced the cubicle type Proportioneer which serves for the continuous blending of two or more liquid ingredients. Among its applications are the blending of different viscosities of petroleum products in predetermined proportions, the diluting of heavy chemicals from commercial strength to plant requirements, and similar applications. Reclaimed rubber, mineral and vegetable oils, soap and road coverings are products for which the new equipment is suggested.

The new proportioning machine is completely engineered, assembled and piped for installation at the factory. It is necessary only to connect the supply pipe to the machine and the outlet piping to the finished stock tank or other process equipment. Installations are specifically engineered for the particular application. For example, in a design employed in rubber reclaiming, the machine consists of a metering type proportioning unit for handling each of the several ingredients, caustic soda, naphtha and paraflux. Each feed pump has an adjustable stroke length and the stroking rate is controlled by a meter operating a special pilot valve.

New "S" 100 burner

Direct-set indicating controller



Quartz Lamp

FOR THE commercial production of ultraviolet radiation, the Hanovia Chemical & Mfg. Co., Newark, N. J., has perfected a new and more efficient lamp of the self-lighting quartz mercury-vapor-arc type. The lamp operates on alternating current through a reactive transformer. It is small, compact and inexpensive. An ultraviolet intensity of 6,000 microwatts of radiations of 3,130 angstrom units, and shorter, at a distance of 3 in., is produced. The lamp can be operated in any position and is not affected by ordinary shocks and jars. It is designated as the "S" 100 burner. Its power consumption is 100 watts.

Indicating Controller

DEVELOPMENT of new direct-set indicating controllers, Model 9-TIC for temperature and Model 9-PIC for pressure, has been announced by the C. J. Tagliabue Mfg. Co., Brooklyn, N. Y. These controllers are supplied in both on-off and throttling types. In both types the white control pointer and the red setting pointer indicate on a 5½ in. graduated scale. All of the company's latest improvements, including an interchangeable calibrated tube system and the use of stainless steel for all important parts, have been incorporated in these instruments.

Sealed Bearing

THE NEW TYPE of ball-bearing pillow block, offered under the name of Sealmaster by Stephens-Adamson Mfg. Co., Aurora, Ill., features self-alignment, prelubrication and permanent sealing. Lubrication is accomplished through the use of hydraulic fittings. The seal is of a positive centrifugal type, consisting of two inner and two outer steel seals. Ball bearings are of the deep groove type, with large contact area for high load capacity. The design is such as to accommodate up to 4 deg. of misalignment.

Sulphur Dioxide Recorder

COMPLETE ELIMINATION of cell corrosion and acid mist are claimed for the new Micromax sulphur dioxide recorder recently announced by Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Using a standard glass measuring cell assembly, the equipment is stated to hold its calibration continuously. Sulphuric acid mist, a former cause of calibration error, is removed by an efficient filter. The cell assembly is said to operate

for weeks without attention. Changes in humidity do not affect its calibration, the lag is minimized, and continuous samples may be drawn from the flue immediately after the gas leaves the burning chamber, according to the makers.

The equipment is of the thermal-conductivity type and the circuit of the alternating-current Wheatstone bridge variety, operated without batteries or rectifiers. The recording instrument is of the Micromax, roll-chart, balanced type.

Furnace Pressure Controller

FOR ACCURATE CONTROL of furnace pressure, the Brown Instrument Co., Philadelphia, Pa., has announced the development of the Air-o-Line furnace pressure controller, an instrument for indicating and controlling any pressure within the range from —5 to +5 in. w.g. The controller is essentially a sensitive inverted-bell type draft indicator, combined with this company's Air-o-Line control unit. Automatic reset and fully adjustable throttling range are provided to insure constancy of control point and the elimination of cycling and hunting. According to the manufacturer, the instrument has consistently held furnace pressures within plus or minus 0.002 in. w.g. Furthermore, practically instantaneous operation is claimed. The instrument is recommended for use on all types of furnaces, stills, kilns, ovens and other similar equipment where a low differential or static pressure must be maintained.

Stainless Steel Valves

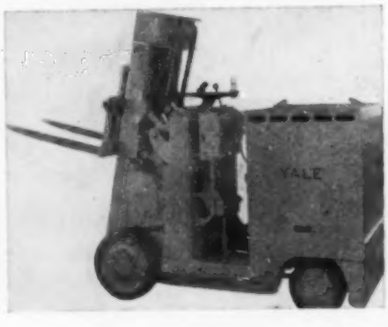
JENKINS BROS., 80 White St., New York, N. Y., have announced an improved line of corrosion-resisting stainless steel valves, available in seven different styles, including solid wedge or double-disk gate valves, union bonnet or bolted bonnet, regrinding globe or angle valves, and bolted bonnet Y valves, all in either screwed or flanged patterns and in sizes from ½ to 3 in. Cooper 18-8 S and Cooper 18-8 SMo alloys, each having a carbon content limited to a maximum of 0.1 per cent, are employed, the latter for more severe conditions as in sulphite pulp mills. Still other alloys are available for use if necessary and may be secured on special order.

Indicating furnace pressure controller

Center Control Fork Truck

CAPACITIES from 1,500 to 20,000 lb. are available in an improved line of center-control tilting fork trucks developed by the Yale & Towne Mfg. Co., Philadelphia, Pa. The center control truck is stated to have many operating advantages, most important of which is perfect visibility for the truck operator at all times, combined with the protection this arrangement affords him against accidental injury. The new Model K41 truck has a minimum overall height of 83 in. and is capable of elevating the forks to a maximum height of 102¾ in. The upright frame is tilted back 10 deg. and forward 5 deg. by two heavy racks so that any degree of tilt may be held at the will of the operator.

New Model K41 fork truck



Correction

THROUGH an unfortunate transposition of ideas, the American Heat Reclaiming Corp., 1270 Sixth Ave., New York, N. Y., makers of the spiral heat exchanger described on page 615 of our November, 1938, issue, was misnamed in that article. The name given there, American Heat Recovery Corp., is incorrect.

MANUFACTURERS' LATEST PUBLICATIONS

Chemicals. Glyco Products Co., 148 Lafayette St., New York City—New catalog entitled "Chemicals by Glyco," giving complete index of this company's products, with formulas and uses. Contains new information and various added features.

Chemicals. Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia, Pa.—8-page booklet describing properties and uses of Kryolith, this company's natural cryolite supplied for use in the aluminum, glass and enamel, and ceramic industries.

Coolers. Fuller Co., Catasauqua, Pa. —Bulletin CO-1—4 pages describing in detail the new Fuller inclined-grate cooler for air quenching clinker from cement kilns.

Couplings. Parker Appliance Co., 17325 Euclid Ave., Cleveland, Ohio—Bulletin 37D—70 pages on this company's tube couplings and associated equipment, covering numerous types of fittings, and listing prices.

Electrical Equipment. General Electric Co., Schenectady, N. Y.—Publications as follows: GEA-594B, automatic control panels for industrial electric heating; GEA-2872, 24 pages describing metal-inclosed switchgear; GEA-2964, detailed photographic description of a new full-voltage magnetic starter.

Electrical Equipment. The Pyle-National Co., 1334 North Kostner Ave., Chicago, Ill.—Publications as follows: Bulletin 1110, 12 pages on rectangular conduit connection boxes with dimensions and prices; Bulletin 1115, 14 pages giving similar information on a broader line of boxes, together with other electrical connection accessories; Bulletin 1125, 11 pages describing and giving prices on a variety of vapor-tight lighting fixtures for industrial use.

Equipment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 161—96-page bulletin on equipment for metallic, nonmetallic and associated industries, covering equipment for classification, concentration, crushing, drying, grinding, materials handling, power production and utilization, pumping, roasting, calcining and smelting, screening, testing, washing and other operations.

Equipment. Falstrom Co., Passaic, N. J.—Bulletin describing certain of this company's products, including a variety of industrial ovens and dryers, steel instrument panels, and a new dust control unit comprising in a single unit a motor-operated exhauster and filter.

Equipment. The Lummus Co., 420 Lexington Ave., New York City—Bulletin CD-1—16 pages on this company's distillation equipment, illustrating and describing various applications.

Instruments. The Brown Instrument Co., Philadelphia, Pa.—Folder G-37—8-page folder briefly describing and illustrating this company's complete line of indicating, recording and controlling instruments for measuring temperatures, pressures, flows, liquid levels and humidity.

Instruments. B. O. Bushnell, 541 North Kings Road, Los Angeles, Calif. —Bulletin T.C.4—6 pages illustrating, explaining and giving information on applications of this company's wide-range temperature controller.

Instruments. Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.—Catalog N-95-163—20 pages on this company's Micromax condensate purity instruments for use in steam plants.

Linings. Homogeneous Equipment Co., Downingtown, Pa.—4-page bulletin describing this company's services in the production of homogeneous lead and tin linings for process equipment.

Materials Handling. American Monorail Co., 13107 Athens Ave., Cleveland, Ohio—48-page book on the solution of materials handling problems through the use of overhead handling equipment, showing numerous installations.

Materials Handling. Johns Conveyor Division, The Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio—8-page booklet briefly describing the Johns moving pipe line conveyor and illustrating typical applications.

Metal Hose. Flexible Metal Hose & Tubing Institute, 150 Broadway, New York City—20-page booklet on construction and utility of flexible metal products, portraying a wide variety of uses.

Mixers. Mixing Equipment Co., Rochester, N. Y.—8 pages on Lightnin portable mixers with engineering and de-

scriptive data and information on applications in process industries.

Photo Cells. United Cinephone Corp., 43-37—33d St., Long Island City, N. Y. —11-page booklet entitled "Marvels of the Electric Eye," describing this instrument and its applications, in language comprehensible to the layman.

Pipe. Babcock & Wilcox Tube Co., Beaver Falls, Pa.—Technical Bulletins 9 and 10—First bulletin covers methods of working intermediate grades of this company's Croloy steels; second discusses effect of silicon on properties of certain chrome-molybdenum steel tubes.

Plaskon. Plaskon Co., Toledo, Ohio. —Booklet illustrating outstanding applications of this plastic and showing its part in remodeling many industrial and domestic articles.

Power Transmission. Reeves Pulley Co., Columbus, Ind.—8-page folder describing construction of this company's variable speed Motodrive, showing also various types of controls.

Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—Bulletins W-341-B2 and W-450-B19C—4-page bulletins respectively covering this company's Type H centrifugal pumps for refinery service; and Types QE and QAE deep-well pumps.

Resins. The Resinous Products & Chemical Co., 222 West Washington Square, Philadelphia, Pa.—Bulletin T-5 —31 pages on this company's Tego resin film for bonding plywood, with information on plywood manufacture and illustrations portraying a wide variety of uses.

Safety Equipment. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.—Bulletin MB-1—Leaflet describing new Models K and M2 Edison-storage-battery-powered hand lamps of 25,000 and 12,000 c.p., respectively. Also Bulletin DK7, leaflet describing winter linings for Skullgard protective hats.

Screens. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Bulletin 1478-B—12 pages describing this company's low-head horizontal screens, showing various types and giving sizes and dimensions on single, double and triple-deck models.

Steel. Joseph T. Ryerson & Son, P. O. Box 8000A, Chicago, Ill.—28-page book on this company's steels and allied products, with information on methods used to assure quality, and digest of standard and special alloys with general hints on heat-treating.

Stoneware. The United States Stoneware Co., 60 East 42d St., New York City—Bulletin 503—30-page catalog, covering chemical stoneware laboratory sinks and Flexlock rubber joints for chemical stoneware pipe lines.

Valves. Jenkins Bros., 80 White St., New York City—Bulletin 100—25 pages, plus blueprints, dealing with this company's stainless steel valves. Gives detailed tabular information on corrosion-resistant properties of materials employed; also information on special alloys for special services. Valve construction completely illustrated by blueprint cross-sections carrying numerous notes on details.

Valves. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.—Bulletins B-420 and B-430—24-page bulletins describing respectively blow-off valves for low- and medium-pressure; and for high pressure boilers. Give complete descriptions, parts and price lists, and information on applications.

Further Details on Power Show

EDITORIAL STAFF

A continuation of the report which appeared on pages 706 and 707 of our December, 1938, issue, in which selected new developments shown at the 13th National Power Show were described. The earlier report took up equipment for power transmission, water treatment, dust collection, materials handling and liquid handling, as well as valves.

Among the pipe and fittings and other devices for fluids handling were several new developments. Crane Co., Chicago, showed cast steel headers for use with welded piping, made of carbon molybdenum steel, and designed for use with hot oil or steam at pressures to 1,500 lb. and 950 deg. F. total temperature. The Genspring pipe hanger of the Grinnell Co., Providence, R. I., has been redesigned for easier field erection and for easier check on the performance. This company showed a new welded Y fitting and a new self-cleaning air-operated water atomizing nozzle so constructed that shutting off the pressure operates automatically to clean both the air and water orifices.

Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa., showed its new G.G. illuminator for gage glasses, a parabolic reflector being used to give high intensity for a low wattage lamp. This company's line of Impulse steam traps has been extended, now including ½, ¾ and 1 in. sizes for 1,500 lb. pressure and 900 deg. total temperature. The bodies are of cast molybdenum steel, the valves of stainless steel and the seats Stellited into the body. A strainer is included. These traps weigh but 30 lb. compared with about 200 lb. for traps of conventional design, built for the same conditions. Other new traps were shown by the Sarco Co., New York. This concern has a new inverted bucket trap equipped with a capsular type thermostatic air relief. The valve and seat are of stainless steel and a strainer is incorporated in the construction. Sizes range from ½ to 1x1½ in. This company also showed its recently developed motor-operated strainer, a pipe-line strainer with a continuously rotating discharge scraper which keeps the screen clean and in certain circumstances makes the device suitable for continuous filtration of relatively coarse material from a flowing liquid.

Plimetal tubes produced by a recently developed production method were shown by the American Brass Co., Waterbury, Conn. Tubes of base metals have been covered or lined for some time with various corrosion-resisting metals. The new process, however, which is used for covering or lining tubes of any desired metal with copper and copper alloys, is believed to be the first to use the regular methods of tube drawing. A tube for use as a lining is slipped inside a tube of a metal to be lined and the latter is drawn down on the lining by means of a die. Conversely, a tube to be used for covering another metal is also drawn down on the interior tube. This company's American Metal Hose Branch has recently developed a new vibration eliminator, consisting of a length of flexible metal tubing to the ends of which are welded solid tubing sections for attaching into the pipe line in which it is desired to stop vibration.

A new synthetic rubber hose, Impervoil, with a metal wire reinforcement in the center, was displayed by Louis H. Hein Co., Narberth, Pa. Its principal feature is a unique type of union coupling which is built into the ends of the hose, thus eliminating several pipe fittings in each installation.

Rotary Seal Union is the name given to a new union for steam heated or water cooled rolls shown by the Rotary Seal Co., Chicago. Fluid enters through an annular space between the coupling and a small center tube, and the condensate or other leaving fluid passes out through the center tube.

Corrugated flexible copper tubing was shown in new large sizes up to 6 in. I.D. by Packless Metal Products Co., Long Island City, N. Y. This company also showed a connector for small-size copper tubing which automatically flares the end of the tube when the two parts of the connector are screwed together. Avioflex, a new type hose for oil connections utilizing a multiple cellulose sheet seal between flexible metal core and synthetic rubber cover, was displayed by the Chicago Metal Hose Corp., Maywood, Ill. Also included in this exhibit were several sizes of 18-8 stainless steel bellows tubing for weigh tank connections and a flexible connecting tubing made of alternate short sections of rigid pipe and woven-wire-covered bellows which permit greater bending and easier and cheaper replacements.

A new internal spring loaded ball and swivel pipe joint for taking care of expansion and contraction was featured by the Barco Manufacturing Co., Chicago.

Instrument makers were not as numerous at the Show as usual but there were nevertheless a considerable number of new developments. Republic Flow Meters Co., Chicago, showed a new ring-balance type of meter for measuring the flow of dirty or corrosive gases at low differential pressures. The instrument employs a tilting manometer in ring form, mounted to tilt freely so as to operate this company's well known type of remote electrical transmitter. This company's Smoot Division exhibited an improved ratio adjustment for its regulators. Crosby Steam Gage & Valve Co. demonstrated a new type of illuminator for indicating instruments, consisting of a gas discharge tube coiled around the dial, out of sight,

but thoroughly illuminating the dial face. This concern also has a new four-pen pressure recorder which features an interchangeable tube system, stainless steel pens, a micrometer pen arm adjustment and a novel and easily operated push-and-pull chart hub.

A new air-actuated remote recorder and controller was demonstrated by American Meter Co., Metric Metal Works, Erie, Pa. A sending unit installed at the point of measurement of the variable (temperature, level, flow rate, etc.) contains a rotary pilot valve and a spring loaded bellows. Movement of the indicator adjusts the pressure of low pressure air or gas in the bellows in proportion to the value of the variable, and this presture is transmitted through a seamless tube to a similar bellows actuating the recording elements in the receiving instrument.

Hays Corp., Michigan City, Ind., showed an improved model of its Orsatomat automatic Orsat analysis equipment. Lucite has been used for molding the chemical chamber, with the advantages of transparency and simplified molding. This company has developed a new line of ratio meters suitable for measuring the flow ratio of either oil or gas fuel and combustion air. A new air flow gage employing a liquid sealed differential bell arrangement and a square-root-extracting movement to give an even indicating scale was shown by Ellison Draft Gage Co., Chicago, which also exhibited a new inclined tube manometer calibrated in air velocity for air flow measurements with a pitot tube. A new diaphragm-actuated draft gage having a straight line indicating movement was shown, similar in principle to the company's liquid sealed gage, and comparable in accuracy.

Its recently developed wet-gas CO_2 meter was exhibited by the Leeds & Northrup Co., Philadelphia. This instrument, which is of the type employing a thermal conductivity cell for measurement, is said to have gotten away from errors due to incomplete drying of the gas by the simple expedient of saturating the gas with water vapor and allowing for this condition in the calibration of the instrument. An all-glass measuring system obviates corrosion problems.

The Stack-O-Meter is a new device manufactured by the Wm. O. Hebler Co., Newark, N. J., for the purpose of measuring electrically on one instrument the CO_2 content and the temperature of stack gases. A thermal conductivity bridge operated on ordinary flash light batteries is used for CO_2 determination. Direct dial reading, compactness and portability are important feasures.

The booth of the A. W. Cash Co., Decatur, Ill., featured the latest development in its line of pressure reducing valves—a diaphragm motor valve with parabolic disks and an improved cartridge lubricated stuffing box. Newly developed for use with this pressure reducer is a pilot-operated controller which regulates the pressure on the diaphragm of the motor valve.

R. W. Cramer & Co., Inc., New York, exhibited a new line of running-time meters and interval timers. The meters are driven by slow-speed, self-starting synchronous motors and may be connected directly to a machine for automatic operation.

A newcomer at the Show was the Grove Regulator Co., Oakland, Calif., showing the Universal diaphragm valve regulator for air, gas and steam. By means of gas or air sealed within a dome at the desired control pressure to balance the diaphragm, the discharge line from the regulator is maintained at any predetermined pressure up to 6,000 lb. for oil or 2,000 lb. for steam.

New in principle is the Level-Trol liquid level controller which was shown by Fisher Governor Co., Marshalltown, Iowa. A long hollow cylinder rises and falls with the liquid level, but not at the same rate. Its slightest change actuates an orifice to control air pressure on a diaphragm motor valve. This company also showed the new Fisher-King gas pressure booster, a device for automatically increasing the downstream gas pressure in a distribution system to offset the pressure drop due to friction and so maintain constant pressure at the low pressure point regardless of the demand load. An orifice in the line resets the pressure regulator in accordance with the flow.

Several exhibits showed new boiler setting and refractory developments. Geo. P. Reintjes Co., Kansas City, Mo., demonstrated new designs in furnace refractory supports and furnace casing construction. One new development was the use of air-cooled piping for supporting the boiler arch refractory hangers. A new type of refractory hanger is made in two pieces which hook together around the supporting pipe, so as to make a solid hanger, yet are readily separated for demounting. For locking Transite or steel panels in place to the supporting framework of a furnace casing, this company showed a simple cam-like casting which, inserted through a hole drilled in the supporting frame, is given a partial turn with a wrench to lock the panel securely. Removal of the panel can be accomplished with equal facility.

A new fused-alumina-base super refractory insulating brick for temperatures as high as 3,200 deg. F. was shown by the Carborundum Co., Perth Amboy, N. J. This brick, known as Alfrax BI, weighs but 4½ lb. per standard size brick, and has a K value of 2.62 B.t.u. per inch of thickness, deg. F. and hour.

Considerable electrical equipment, for control and other purposes, was in evidence. The Rowan Controller Co., Baltimore, has recently started production on a new type switch box which features the lead-in terminals in a separate compartment above the oil level to facilitate installation. Also shown in the Rowan booth was a single unit comprising a reduced voltage starter and safety switch entirely oil immersed—including fuses.

Among new products displayed by Allen Bradley Co., Milwaukee, were: an automatic alternator for duplex pump installations, designed to promote equal use of line and standby pumps; a new line of thermostats and pressure and vacuum control switches; explosion-proof limit switches: heavy duty pushbutton stations; and a combination of circuit breaker and motor starter in one casing.

In the field of filtering equipment, Cuno Engineering Corp., Meriden, Conn., showed the new Flo-Klean filter. Used chiefly for fluids containing abrasives, the new unit filters by drawing the fluid inward through the walls of a rotating cylinder composed of fine wire rings. The cake is loosened by a small amount of the filtrate which is continuously fed back through the rings at one point on the periphery of the cylinder, and is removed by scrapers. Another type of filter, an eight-bag filter with a capacity of 130 gal. per min., was shown by Wm. W. Nugent & Co., Chicago. The unit is cylindrical, the bags spiralling out from a central spindle which, along with the complete filter unit, can be lifted out of the housing by an attached winch and hoist mechanism.

Considerable equipment that does not fit readily into the classifications of this article appeared in the booths of many of the exhibitors. For example, Ampco Metal, Inc., Milwaukee, has added a universal bung wrench, which fits 14 different types and sizes of bungs, to its line of non-sparking safety tools.

The Ozalid Corp., Johnson City, N. Y., demonstrated its high-speed Ozalid print machine for making white prints of drawings at the rate of 20 ft. per min.

For the remote manual operation of valves, Condenser Service & Engineering Co., Hoboken, N. J., showed a unique universal bevel gear capable of transmitting rotary motion between its two shafts at any angle within a range of 135 deg. A single unit can be used where sometimes two or even three universal joints would otherwise be required. Available sizes range from ¾ to 1½ in. shaft size.

A novel type of compound blower construction said to give unusually high efficiency in forced draft service was exhibited by L. J. Wing Mfg. Co., New York. The unit comprises two disk fans mounted on the shaft of a motor which is between the fans. Adjustable volume control vanes are provided between the first and second fan stages. The whole assembly is mounted within a split casing. This company also showed an interesting new unit heater for large areas. The heater discharges heated air downward through a slowly rotating bifurcated discharge nozzle which is said to produce a high degree of air turbulence and distribute the heat over a large area.

Chemical Engineering NEWS

Engineers Will Investigate Patent Policies

The Patents Committee of American Engineering Council will be the nucleus of a group which will make a comprehensive technical and economic study of the patent system. This project is being sponsored by the National Industrial Conference Board. It will be managed by N.I.C.B. and A.E.C. jointly.

The Patents Committee of A.E.C. has been working on this type of subject for a number of years, and more than two years ago recommended a fundamental study of the public aspects of patents and the economic and industrial consequences of their use. This committee, under the chairmanship of R. S. McBride, consulting chemical engineer in Washington, is made up of: K. H. Condit, executive assistant to the president, National Industrial Conference Board; J. H. Critchett, Union Carbide & Carbon Research Laboratories, Inc.; F. B. Jewett, Bell Telephone Laboratories; Warner Seely, Warner & Swasey Co.; and W. M. Grosvenor, consulting chemist of New York.

This project will be closely interlocked with the comprehensive study now being made by N.I.C.B. of the American Enterprise System. Dr. Robert F. Martin, who directs this major study under President Virgil Jordan, will care for the economic aspects of the patent inquiry and arrange for close coordination with the more comprehensive studies of N.I.C.B. The special investigators for the patent inquiry will make their headquarters in the offices of American Engineering Council at Washington.

Model State Insecticide Law Under Study

Draft of a model for state insecticide and fungicide laws is being studied by experts of the Manufacturing Chemists Association and of the National Association of Insecticide and Disinfectant Manufacturers. The draft of the model law has been approved by the Manufacturing Chemists Association insecticide and fungicide committee. It is intended to aid in the passage of uniform legislation in the several states early in 1939.

Under the proposed law registration annually of insecticides, fungicides, disinfectants, herbicides and rodent killers would be required. The model law deals with standardization, adulteration and misbranding of these products. The law proposed penalties for violation but they are relatively light. A fine of not more than $25, is proposed for the first offense and of not more than $100 for any subsequent violation.

Price-Fixing Charged To Charcoal Producers

Nineteen producers of hardwood charcoal are charged in a complaint issued by the Federal Trade Commission with participating in price-fixing conspiracies for the purpose of eliminating and suppressing price competition in the sale of their product to the wholesale and retail trade. These producers allegedly manufacture approximately 70 per cent of the country's output of hardwood charcoal, which is used principally as a fuel.

Also named as respondents are two non-producing corporations, Hardwood Charcoal Co., Memphis, Tenn., and Manufacturers Charcoal Co., Bradford, Pa. which allegedly were organized to act as exclusive sales agents for all but two of the respondent producers.

Hardwood Charcoal Co., the complaint charges, is the sales agent for the respondents Tennessee Products Corp., Nashville; Forest Products Chemical Co., Memphis, and Crossett Chemical Co., Crossett, Ark. Each of these companies, it is alleged, sells its entire output at cost to Hardwood Charcoal Co., which fixes the resale prices, and each receives its proportionate share of the profits of, and bears its proportionate share of the cost of maintaining, its sales agency.

The complaint describes Manufacturers Charcoal Co. as a non-profit sales organization, to which the following 14 producers sell their entire output, and, in return, are paid the net amount received by the sales organization from the ultimate purchasers, less the pro rata sales expense: Clawson Chemical Co., Ridgway, Pa.; Custer City Chemical Co., Custer City, Pa.; Genesee Chemical Co., Genesee, Pa.; The Gray Chemical Co., Roulette, Pa.; Heinemann Chemical Co., Crosby, Pa.; Thomas Keery Co., Inc., Hancock, N. Y.; Kinzua Valley Chemical Co., Williamsport, Pa.; Mayburg Chemical Co., Endeavor, Pa.; Morris Chemical Co., Smethport, Pa.; Oswayo Chemical Co., Genesee, Pa.; Otto Chemical Co., Williamsport, Pa.; Pennsylvania Charcoal & Chemical Co., East Smethport, Pa.; Union Charcoal Co., Olean, N. Y., and Harry Treyz, trading as G. H. Treyz & Co., Cooks Falls, N. Y.

The complaint alleges that there are three unlawful combinations in restraint of trade involved in the case, except for which active and substantial price competition would continue to exist among all of the respondents. According to the complaint, one combination is made up of Hardwood Charcoal Co., and the three producing companies for which it acts as sales agent; another includes Manufacturers Charcoal Co. and the 14 companies it serves in a similar capacity, and the third comprises all of these respondents and two others, Tennessee Eastman Corp., Kingsport, Tenn., and Cliffs-Dow Chemical Co., Marquette, Mich., each of which sells direct to purchasers, and not through the agency of either of the sales organizations.

Arthur D. Little Makes Change in Policy

Arthur D. Little, Inc., consulting chemists and engineers of Cambridge, Mass., has announced the discontinuance of routine testing and chemical analysis, other than as required for the research and development work on which the organization is principally engaged. The reason for the change of policy was given as due to steady increases in the extent and variety of industrial research, requiring the full attention and physical facilities of the organization. According to the announcement, requests for routine analyses and tests will be referred to Skinner & Sherman, Inc., Boston, Mass. Both Hervey J. Skinner and Herbert L. Sherman of that company were at one time executives of Arthur D. Little, Inc.

To consolidate more effectively the transfer of its analytical business, Harold C. Parish, for many years assistant director of the analytical department of Arthur D. Little, Inc., is joining the staff of Skinner & Sherman, Inc., and Roger C. Griffin will serve on its board of directors for the coming year.

Food and Drug Regulations In Print

In the Federal Register of Wednesday, Dec. 28, was published the official draft of the new food and drug regulations promulgated by Secretary Wallace following the hearings of late November. These regulations describe the conditions under which the Food and Drug Administration will proceed in the application of some of the major sections of the new Food and Drug Law.

Printed copies of these regulations will become available shortly and will be supplied to those interested when they are ready for distribution.

Fluid Dynamics Considered At A.C.S. Symposium

Well over 100 chemical engineers and chemists attended the fifth chemical engineering symposium of the Division of Industrial and Engineering Chemistry of the American Chemical Society, which was held at the Carnegie Institute of Technology in Pittsburgh, Dec. 27 and 28. One session of the four was held jointly with the Society of Rheology.

A total of 18 papers was presented, in addition to a motion picture on the manufacture and use of aluminum and a talk on aluminum research presented by Junius D. Edwards, of the Aluminum Co. of America. Papers at the first session included one on turbulence and diffusion, by Hugh L. Dryden; one on the direct solution of isothermal flow in long pipes, by C. F. Bonilla; and one giving an improved method for the direct solution of isothermal flow in pipes, by B. F. Ruth. Dr. Dryden's paper described the results of work on air flow which had been undertaken in connection with wind tunnel experiments. The papers by Drs. Ruth and Bonilla both presented simplified methods for pipe pressure-drop calculations.

During the second session L. M. K. Boelter and R. A. Kepner discussed the pressure drop accompanying two-component flow through pipes. Using air and oil, these workers obtained data under special conditions, but not enough work has yet been done to permit generalizations. The concurrent flow of liquids and gases in pipes was discussed in the absence of the author, R. L. Hershey, by T. B. Drew, who described some air-lift experiments. Interesting data were presented by L. T. Work and V. W. Haedrich, dealing with the effect of the molecular weight of the vapor handled by jet type ejectors. Work on no-entrainment, self-entrainment, and two-fluid systems showed that for a given ejector a single relation can be determined for all fluids, correlating boiler and exhaust pressure in comparison with the Carnot efficiencies for compression and expansion.

C. B. Shepherd and C. E. Lapple described work on an experimental cyclone separator in which the effect of variations in design was correlated with pressure drop. The work had not gone far enough to show the effect on collection efficiency.

Valuable information from the accumulated experience of an engineer long associated with application of chemical pumps was given by W. E. Pratt, who described the principal pump types and gave it as his conclusion that most problems are best solved with properly selected centrifugal pumps. He emphasized the particular value of water sealed glands.

The second day's sessions commenced with a discussion of flooding and liquid holdup in packed towers, by J. C. Elgin and F. M. Weiss. The authors confirmed the previous belief that the flooding point corresponds with a definitely characterizable condition and offered a method for plotting results to facilitate interpolation. J. C. Whitwell and D. S. Plumb described a method of correlating the flow rates of various liquors through a single rotameter, taking into consideration both viscosity and density. They also discussed the effect of varying the density of the float. W. L. Towle, T. K. Sherwood and L. A. Seder described work on eddy diffusion in a turbulent air stream. The so-called eddy conductivity was found to be the same for various gases mixed in the air, and about 100 times the molecular diffusivity.

H. S. Gardner and J. H. Folwell described methods for reducing the shock pressure caused by closing a valve at the end of a pipe line carrying liquid. They found that the use of a slow-closing valve was the best general solution to the problem.

At the last session, M. D. Hersey reviewed the application of dimensional analysis to fluid motion. Work showing that a reliable generalized method for the determination of pipe resistance in the transition zone between viscous and turbulent flow is not yet available, was reported by M. P. O'Brien. R. G. Folsom and Finn Jonassen. R. H. Ewell discussed means for classifying the viscosity and other properties of liquid mixtures whereby good agreement with experiment is obtained. R. H. Wilhelm, D. M. Wroughton and W. F. Loeffel, discussing work on the flow of suspensions, described an experimental concentric cylinder viscosimeter for both suspensions and clear liquids. They also reported work on pressure drop of various suspensions pumped through pipes.

Electro-Platers Will Meet At Asbury Park

The Newark, N. J. Branch of the American Electro-Platers Society, which will conduct the annual convention this year, has selected Asbury Park, N. J. as the place of meeting and June 19-22 as the dates for the meeting. The 1939 convention will be an international affair.

The educational sessions will consist of discussions and papers pertaining to Electroplating, to be contributed by some of the noted chemists and platers of the world.

There will be exhibits by manufacturers of plating and polishing, metal cleaning, burnishing, electrical equipment, and manufacturers of supplies and chemicals. There will also be a large exhibit by manufacturers and platers of plated articles of all descriptions. The committee has arranged for visits of inspection to some of the large plants in New Jersey.

Chemical Film Neutralizes Rebounding Light Rays

Glare from reflected light has been removed by a new process developed in General Electric Co.'s research laboratory by Dr. Katharine B. Blodgett. By applying thin chemical films to the surface of glass, Dr. Blodgett has been able to nullify or neutralize rebounding light rays with the result that pictures framed with glass so treated appear as though there was no glass at all, regardless of the angle viewed from. The same is true with clock faces, show cases, display windows; in fact, any place where glare is caused by light reflections on glass.

The process consists of building or attaching to the glass a very thin transparent film of about four millionths of an inch, or exactly one quarter wave length of light, in thickness. As light falls upon the film, rays are reflected from both the upper and lower surfaces. With the film exactly one quarter wave length in thickness, those rays coming from the outer or upper surface are equal in intensity and opposite in phase to those rays reflected from the lower surface, thus counteract one another and no light is reflected.

"The process is still in a laboratory stage," Dr. Blodgett explained. "At present it has not reached such a stage that it can be offered the public. However, we are hopeful that we may soon do so.

"Glass is treated by dipping it into a tank of liquid, on the surface of which is a film of insoluble soap but one molecule thick. As the glass is pushed down one layer of the film becomes attached and as it is pulled up another is applied. Thus each immersion adds two layers of the film, each but one molecule thick. The dippings are continued until we have built up about 44 layers which form a thickness of one quarter wave length, or about four millionths of an inch. We can measure or determine the exact thickness of the film at any time, although it may be thinner than any substance we know of today, by an optical process."

Chlorine Price Agreements Forbidden By F.T.C.

Chlorine price agreements have been forbidden by the Federal Trade Commission in an order directed to nine chlorine producers, who are directed to cease and desist from combining to fix uniform prices for the product. The firms named in the order are: The Belle Alkali Co., Belle, W. Va., The Columbia Alkali Corp., New York, The Diamond Alkali Co., Pittsburgh, the Electro Bleaching Gas Co., New York, The Hooker Electrochemical Co., New York, the Mathieson Chemical Works, New York, Monsanto Chemical Co., St. Louis, the Pennsylvania Salt Manufacturing Co., Philadelphia, and the Solvay Sales Corp., New York.

NEWS FROM WASHINGTON

Washington News Bureau
McGraw-Hill Publishing Co.
Paul Wooton, Chief

LET US ARM to preserve religious freedom. This was the theme song of the President's message on the state of the Union as presented to Congress January 4. And it was a superb political move to give assurance to Congressmen and Senators worried by pacifist sentiment back home that they could safely go along on a big Army and Navy development program. As a result of this new approach there remains only a question as to how fast Congress will move and how much money it will appropriate.

There are many details of a preparedness program to be formulated; and numerous parts of the programs will have large importance for process industry. Preparedness will take the form of stock piles of raw materials of strategic or critical nature. There will be extensive purchases of manufactured goods to form the primary reserve of supplies and equipment. There will be intensive studies as to the way in which fuel, power, transportation, and other agencies which underly munitions making, can be provided adequately. All of these affect every industry which is even indirectly touched by preparedness.

Promises for "M Day"

Industrial executives are regularly telling the Army and Navy investigators what they will be ready to do on Mobilization Day, how fast they can manufacture or supply goods and services. Such promises are being carefully formulated by most companies and critically reviewed in Washington. Apparently they involve far more than many manufacturing enterprises have understood. Those who have looked beneath the surface find, among other things, the following factors:

A company making such pledge to the War Department should take account of speed-up, extra-shift, and overtime work in case of emergency. It is not adequate to present to the War Department merely an estimate of the output which would be attainable by normal one-shift operation.

In the case of continuous process industries, an assumption of pressure for speed and maximum production can be assumed, but must not neglect the factors of reduced output resulting from delays when raw material is a little short or breakdowns occur. In other words, the Army does not want an over-optimistic speculation of what might be produced if everything went perfectly.

Companies may reasonably assume regular raw materials supply of the types they normally need. But—and this is very important—companies should themselves look into the question of raw materials supply in two ways: (a) They should inquire whether they can get their customary supplies from customary sources if an international emergency developed. (b) They should inquire of their raw materials suppliers to make sure that they have not been compelled to make other commitments for other purposes normal in a military emergency but not normal in peace time. In other words, the raw material man should be asked whether he has made commitments that might cut off supplies on the assumption that the process industry in question is not one of military significance.

An appraisal should be made as to the availability of sufficient numbers of skilled persons to head emergency-production, extra shifts, if the industry is not a continuous one already staffed for uninterrupted manufacture.

The possibilities of new tools or new techniques should be considered to determine whether, by modification of present or peacetime methods, a large speedup suitable for war time might be achieved.

In some cases industries which can pick up a big load if given a few extra months are being asked to indicate what stocks should be carried by the Government in order that this slow pickup may be tolerable.

All estimates are necessarily to be made on the basis of limited times. How much can be done the second or third year is not important; what the Government wants to know is what can be done in the first, second, and third quarter of the first year.

It is being suggested that any industry which has not answered these questions and does not know that Uncle Sam has studied his industry, better make early inquiry as to what his part in a preparedness job might be. Such study will cost very little relative to what might be the expense, both to a company and to the public, if an unconsidered approach were made, even on commodities of seemingly small military significance. Incidentally some process industries may have to find out whether they will not be cut off altogether in a military period and be expected to do something else instead of their normal business.

Better Business

Official estimates in Washington all indicate an expectation of substantially better business for 1939 than in 1938, something comparable with 1937 being hoped for, but not too confidently expected. It is not believed by economists that there is any chance of getting the President's hoped-for $80 billion income development during this calendar year.

Counted on as in the forefront of improved business makers are house construction and automobile building. Those process industries most closely related to that type of activity can expect earliest response. The preparedness spending of Uncle Sam, which will probably take the place of some of the relief spending of the last year or two, will be slower in action, is not expected to be important on industrial budgets at once but probably in the second half of the year.

Anti-Monopoly Efforts

The investigations of Temporary National Economic Committee continue to have more educational and constructive purposes than were expected when T.N.E.C. was organized. To some extent it is expected that byproduct prosecutions and corrective measures will be attempted. But the best informed observers in Washington seem generally to agree that legislation, and not punitive character smearing, will continue to dominate as the prime object sought.

During the past month there have been, however, numerous cease and desist orders from the Federal Trade Commission and some evidences of activity at the Department of Justice with respect to certain chemical enterprises. Certain plate glass makers, the major alkali companies, the marketers of calcium chloride, the hardwood distillation industry, and several other groups have received definite instruction as to future conduct through cease and desist orders of F.T.C.

This whole movement appears to indicate primarily the importance of critical review by business executives of the merchandising practices which are typically under scrutiny by those enforcing the Clayton Act, Sherman Law, and other anti-trust measures. Little, if any, novel significance attaches to the recent cases.

Perhaps most important to process industry of these developments is the clear effort of T.N.E.C. investigators to distinguish between good patent practices

and bad. There has been no clear definition of the distinction, but the general trend of thinking is evident from the distinction made between automotive patents, which are regarded generally as good, and glass-container patents, which certainly came under sharp criticism early in the Monopoly Committee hearings. It is not expected that legislation on this subject will be enacted this session of Congress, though several measures are being drafted and some of them may take the form of Administration bills. Later in this Congress an overhauling of the patent laws will be attempted, and some important changes are anticipated at that later time.

Instrumentation Conference At Carnegie Tech.

Plans have been formulated for a conference on Instrumentation in the Process Industries, sponsored by the Chemical Engineering Department of the Carnegie Institute of Technology, Pittsburgh, on March 2-3. The purpose of the conference is to bring about a better knowledge of the advance made in measurement and control in the process industries. An exhibit will be held in conjunction with the conference. Dr. C. C. Monrad of the Department of Chemical Engineering is in charge of the arrangements.

Ninth Packaging Exposition Scheduled for March

Revolutionary changes in all fields of consumer packaging are imminent as the result of recent federal legislation is the conclusion reached by the American Management Association after a series of meetings it has held to formulate the program for the ninth annual Conference on Packaging, Packing and Shipping and the Ninth Packaging Exposition, at the Hotel Astor, New York, March 7 to 10, inclusive.

"The most conspicuous feature of these meetings," it is stated by Alvin E. Dodd, president of the American Management Association, "is the overwhelming preoccupation of the many outstanding authorities who have been present with the radical changes that the new legislation promises to bring about in all provinces of packaging.

"The unanimity of belief in impending changes is all the more interesting in view of the general uncertainty regarding the exact nature of the influence the various legislative measures will exert on packaging. But at least three widely accepted conclusions emerge: first, that the new legislation, particularly the Food, Drug and Cosmetic Act, will participate drastic changes in the packaging of the industries affected by the act; second, that these changes ultimately will result in a marked increase in the ingenuity and soundness of packaging technique in these fields, which in turn will have a parallel effect on all other industries; and third, that certain measures, notably the wage and hour legislation, will accelerate the tendency toward the increased use of automatic packaging machinery.

"It is inevitable that both the conferences and the packaging exposition will reflect the concern of the package using field with these problems. The tentative programs formulated on the basis of the group meetings of exports promise to do much to help solve the most vexing of these problems that are facing distributors."

Monsanto Makes Promotions In Sales Organization

Promotion of Victor E. Williams, manager of the New York sales branch of Monsanto Chemical Company, to assistant general manager of sales has been announced by G. Lee Camp, vice-president. In his new position, Mr. Williams will divide his time between New York and the Saint Louis headquarters of Monsanto.

A. T. Loeffler, who has been assistant manager of the New York branch, has been promoted to the managership to succeed Mr. Williams.

F. C. Renner, assistant general manager of sales, Merrimac Division of Monsanto, Boston, has been promoted to succeed Mr. Loeffler at New York.

R. C. Gere Heads New Coopers Creek Chemical Corp.

The Coopers Creek Chemical Corp. has been formed at West Conshohocken, Pa., and has purchased the assets of the old Coopers Creek Chemical Co. which had been in business for the last twenty-three years. The new corporation, of which Rollin C. Gere is president, took over the assets of the old company as of Dec. 23 and will continue to manufacture and distribute the same general line of tar and asphalt products.

British Chemical Trade Increased Last Year

From Our London Correspondent

The British chemical industry is still showing signs of increased activity, not necessarily due to contracts occasioned by work for the re-armament program but to a notable extent from developments in other industries generally. It is revealed that trade, as disclosed by figures for daily retail sales, has apparently increased by 2½ per cent during 1938 as compared with 1937. The Government may possibly lend additional financial support to agriculture, and this no doubt will favorably affect certain branches of the chemical industry in so far as fertilizers and weedkillers are concerned.

The subject of oil drilling in the United Kingdom, and also the production of oil from coal, continues to be raised in Parliament in the form of private questions. It is disclosed that the Billingham hydrogenation plant consumed a total of 440,000 tons of coal during 1937, or an average of 37,000 tons per month. Suggestions for establishing works for the manufacture of calcium carbide are still forthcoming from various sources, individual efforts being prompted by the desire to find increased employment in some of the so-called depressed areas.

A new chemical laboratory for the use of the Admiralty has been opened at Sheffield. This laboratory will deal mainly with the analytical control of metals supplied for naval equipment. A new gas grid for the distribution of gas in Yorkshire is to be established by the United Kingdom Gas Corp., which already controls 73 gas undertakings in various parts of the country. The scheme will cost about two million pounds and will involve the installation of about 80 miles of high pressure piping.

Persons engaged in the chemical industry in this country are wondering just what suggestions will be put forward in the Government's new National Service scheme, so far as chemists and chemical engineers will be concerned.

CALENDAR

FEB. 20-23, TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY, annual meeting, Hotel Roosevelt, New York City.

APRIL 3-7, AMERICAN CHEMICAL SOCIETY, spring meeting, Baltimore, Md.

APRIL 16-21, AMERICAN CERAMIC SOCIETY, Hotel Stevens, Chicago, Ill.

APRIL 26-29, ELECTROCHEMICAL SOCIETY, spring meeting, Deshler-Wallick Hotel, Columbus, Ohio.

MAY 15-17, AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Akron, Ohio.

JUNE 18-22, AMERICAN ELECTROPLATERS' SOCIETY, international convention, Asbury Park, N. J.

PERSONALITIES

Albert E. Marshall

✦ ALBERT E. MARSHALL has been elected by the board of directors of the Rumford Chemical Works, Rumford, R. I., to the presidency of the company. He assumed his new duties January 1.

✦ C. P. WILSON has been appointed by the joint executive committee of the California Fruit Growers Exchange, manager of the products department. He succeeds E. T. Cassel who has retired.

✦ DR. SAMUEL C. LIND, dean of the Institute of Technology of the University of Minnesota has been elected president of the American Chemical Society for 1940. The newly elected directors are: Dr. E. R. Weidlein, Thomas Midgley, Jr., and Prof. Arthur J. Hill.

✦ DR. HENRI DREYFUS, co-managing director of British Celanese, Ltd., has been awarded the Perkin Medal of the Society of Dyers and Colourists of Great Britain. Presentation of the award will take place on January 19 at Bradford, England. The award was made for discoveries of work of outstanding importance in connection with the development of the cellulose acetate rayon industry in England.

✦ P. B. KIMBALL has been appointed to the position of chief engineer of the Rumford Chemical Works, Rumford, R. I. He joined the organization in the fall, after serving with S. B. Penick & Co., General Chemical Co., Grasselli Dyestuff Corp. and M. W. Kellogg Co.

✦ HAROLD C. PARISH, for many years assistant director of the analytical department of Arthur D. Little, Inc., Cambridge, Mass., is joining the staff of Skinner & Sherman, Inc. ROGER C. GRIFFIN will serve on its board of directors for the coming year. These moves are made to assist in consolidating more effectively the transfer of the analytical business heretofore done by the Little organization to Skinner & Sherman, Inc.

✦ JOSEPH BECKER, vice-president and a director of Koppers Co., also has been made president of Koppers-Rheolaveur Co. He is the inventor of the Koppers Becker coke oven and of processes for the recovery of byproducts.

✦ F. S. WASHBURN has been appointed director of fertilizer sales for the American Cyanamid Co. He succeeds the late W. D. Huntington. H. V. Cory has been appointed sales manager of the fertilizer division.

✦ JAMES A. BYERS, who recently graduated from Washington and Lee University, has joined the E. I. du Pont de Nemours & Co. He is located at the rayon plant in Waynesboro, Va.

✦ EARLE W. GARD has been appointed director of research and development for the Union Oil Co. of California. He has been development engineer for the company for the past eight years.

✦ DR. THERALD MOELLER, a recent doctorate at the University of Wisconsin, D. H. BYERS of Purdue University, and RALPH L. GUIDE of Michigan State College have been added to the teaching staff of the Department of Chemistry, Michigan State College.

✦ DR. GEORGE FELTON has become associated with the American Maize-Products Co. as research chemist. He will be located at the company's Roby, Ind. plant. Formerly, Dr. Felton was with General Foods Products Co.

✦ GEORGE WALKER has been transferred by the Glidden Co. from its Chicago plant to the American Zirconium Corp. plant at Baltimore, Md.

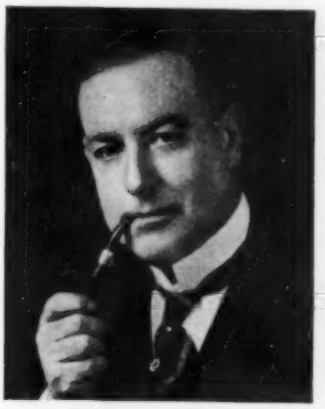
✦ JOHN B. AUSTIN has become associated with Republic Welding and Flame Cutting Co., a division of Consolidated Iron-Steel Mfg. Co., Cleveland.

OBITUARY

✦ PERCY C. DAY, vice-president and chief engineer of the Falk Corp., died December 7, at his home in Elm Grove, Wis. He was 63 years of age.

✦ GEORGE W. MILLER of the Universal Oil Products Co. died suddenly at his home in Tulsa, Okla., on December 14. He was born in Vinita, Okla., in 1893. Mr. Miller had long experience in refinery operation and was known throughout the petroleum refinery industry. He had been a member of the Universal organization since 1923.

✦ DR. LLOYD LOGAN is dead. He died at his home in Syracuse, N. Y., on December 29 after a long illness. He suffered a hip injury last January in a fall on an icy side walk, but the extent of his injury did not become apparent until the summer. He was 47 years old. Dr. Logan had been appointed head of the chemical engineering department of the College of Applied Science at Syracuse University in July, 1937, to succeed Dr. Albert Salathe. Previously he had been a member of the engineering faculty of Johns Hopkins University for ten years.



George C. Lewis

✦ GEORGE C. LEWIS, president of the L. Martin Co., of New York, N. Y., died December 19 in the garden of his home on Staten Island. He was 64 years of age. Mr. Lewis was born in Bombay and educated in England. He came to the United States in 1904 and a short time later joined the Martin organization. He also was associated with Darco Co., United Lamp Black Works, Darco Sales Corp., Bihn & Wolff and Monroe Louisiana Carbon Co. Several years ago he served the Chemists' Club of New York as president.

✦ DR. PORTER W. SHIMER died December 7 at his home in Easton, Pa. He suffered a paralytic stroke a few days earlier. Dr. Shimer received the John Scott Medal from the Franklin Institute for the invention of a combustion crucible and was credited with discovery of titanium carbide.

✦ DR. WILLIAM B. D. PENNIMAN, consulting chemical engineer and president of Penniman & Browne of Baltimore, Md., died at his home on December 17 after an illness of several months. He was 72 years old. His firm was founded 45 years ago and is one of the largest of its kind in the South.

Chemical ECONOMICS and MARKETS

MODERATE DROP IN CONSUMPTION OF CHEMICALS IN LAST MONTH OF YEAR

CONSUMPTION of chemicals in 1938 was about 22 per cent below that reached in the preceding year despite the upward trend which was in evidence in the last six months of the year. Production, however, was similarly curtailed, and in some cases to a greater relative extent, with the result that the industry, both from the consuming and producing points of view, entered the new year in an improved inventory position.

Fairly high rates of operations were maintained in the majority of the consuming industries over the first half of December but there was a noticeable slowing down in the latter part of the month in most lines to which the fertilizer industry offered an exception. Incomplete data indicate that the index for chemical consumption will approximate 112.50 for December as against 114.08 for November and a revised figure of 113.74 for October.

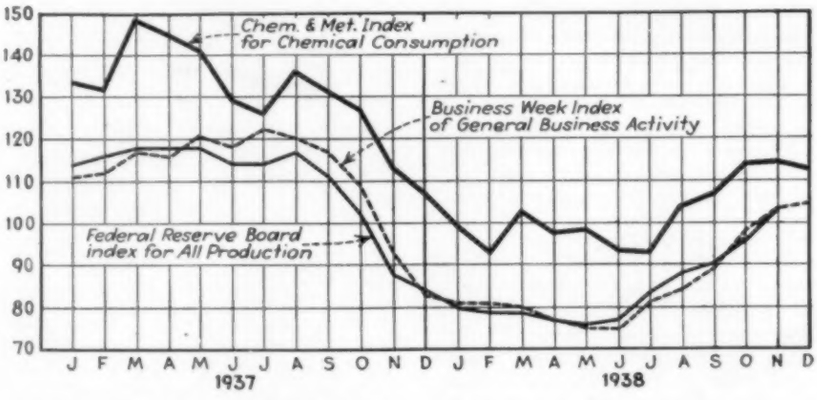
In reviewing the status of consuming industries in November, it is found that while some branches of the glass trade were at their peak for the year, the gains in production were offset by a drop in container output. The high rate of pulp production reached in October did not last through November and, as in the case of other industries, total output was affected by the smaller number of working days. Steel plants made November the best month of the year for that industry. Superphosphate production also widened and accounted for a larger consumption of sulphuric acid. Activity at tire and other rubber goods plants called for larger consumption of crude rubber and both production and consumption of reclaimed rubber joined in the upward movement. All branches of the textile industry operated actively in November and are expected to make a favorable showing in the early months of this year.

For the first quarter of 1937, chemical consumption—as measured by *Chem. & Met's* index—was represented by the index number of 138.03. For the first quarter of 1938 this had fallen to 98.61. An indication of what may be expected for the first quarter of 1939 may be obtained by projecting the index for the final quarter of 1928 which was 113.10. Even a moderate improvement for the quarter would give an average index of 114 which would represent a gain of more than 15 per cent over the first quarter of 1938.

The price structure for chemicals at the beginning of the year was favorable to consumers as contract levels either had been extended to cover 1939 deliveries or downward revisions were made.

In contrast to the dip in chemical consumption in December, other indexes of activity continued on a rising line; for instance the *Business Week* index of general business activity rose to 104 for December, which was a fractional advance over the November figure.

The movement of commodities as anticipated by the Shippers Advisory Boards will represent an increase of 9.9 per cent for the first quarter of this year as compared with the corresponding period of last year. On this authority, deliveries of chemicals and explosives will exceed those of a year ago by more than 15 per cent for the quarter. Among the groups for which increases are estimated for the quarter are: automobiles, trucks and parts with a rise of 54.8 per cent, iron and steel 39.1 per cent, paper and paper board, 9.3 per cent. Shipments of fertilizer are estimated at 2.4 decrease.



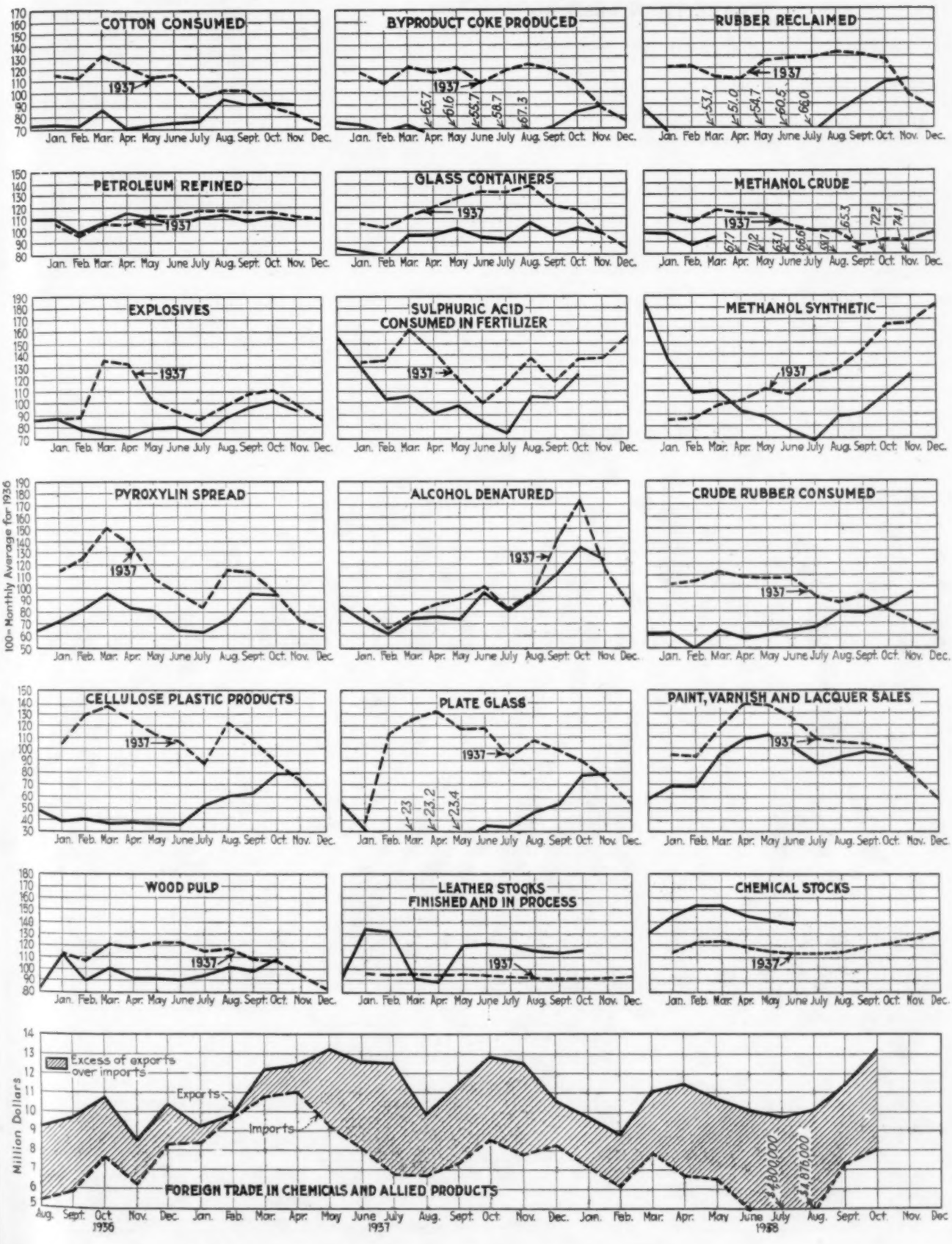
***Chem. & Met.* Index for Consumption of Chemicals**

	October (Revised)	November
Fertilizer	24.04	26.69
Pulp and paper	15.45	14.34
Glass	10.42	10.38
Petroleum refining	13.04	12.66
Paint and varnish	9.74	8.60
Iron and steel	6.60	7.90
Rayon	7.77	7.70
Textiles	7.00	7.40
Coal products	6.27	6.39
Leather, glue and gelatine	3.90	3.56
Explosives	4.69	4.30
Rubber	2.30	2.56
Plastics	1.62	1.60
	113.74	114.08

Production and Consumption Data for Chemical Consuming Industries

	Nov. 1938	Nov. 1937	Jan.-Nov. 1938	Jan.-Nov. 1937	Per cent of decline for 1938
Production					
Alcohol, ethyl, 1000 pr. gal	15,614	18,179	175,856	198,076	11.2
Alcohol, denatured, 1000 wi. gal	10,195	9,813	82,467	92,066	10.4
Automobiles, no	372,358	360,055	2,001,209	4,482,740	55.4
Benzol, 1000 gal	7,619	7,472	63,560	110,674	42.6
Byproduct coke, 1000 tons	3,278	3,222	28,433	46,387	38.7
Glass containers, 1000 gr	3,709	3,735	36,083	44,583	19.1
Plate glass, 1000 sq. ft	12,883	12,517	73,034	183,672	60.2
Cellulose acetate plastics, 1000 lb.	1,332	783	5,719	12,611	54.7
Nitrocellulose plastics, 1000 lb	1,018	1,067	8,699	17,120	49.2
Rubber reclaimed, tons	13,995	12,804	99,975	168,355	40.6
Consumption					
Cotton, bales	596,289	482,976	5,340,058	6,987,939	25.3
Silk, bales	41,599	31,749	376,590	403,317	6.6
Wool, scoured, 1000 lb	31,228	13,334	245,320	340,184	27.9
Explosives, 1000 lb	29,385	31,125	291,874	360,521	19.0
Rubber, tons	46,048	34,025	365,927	512,223	28.6
Waste paper, tons	243,924	218,189	2,566,303	3,213,739	20.1

Production and Consumption Trends



DELIVERIES OF CHEMICALS START ON HIGHER PLANE THAN YEAR AGO

ALTHOUGH a large part of consuming industries covered future requirements in the closing months of last year, the contracting period has extended into the current month with forward buying reported for several selections. The advance in price earlier reported for carbon black resulted in a larger call for stocks late in the year and this has served to cut down somewhat the call for January shipments. The rate of consumption, however, has been stepped up in recent months and prospects are favorable for a continuance of enlarged shipments. In general withdrawals of chemicals against contracts have started at a higher rate than was the case a year ago and confidence in a larger tonnage movement for the first quarter—compared with the first and final quarters of last year—appears to have been well founded.

A reduction in price has been announced for cellulose acetobutyrate with lots of 5 tons or more now available at 48¢ a lb. Cellulose acetopropionate also has been lowered with quantity lots offered at 50¢ a lb. These quotations are f.o.b. producing plant with freight allowed to point of destination. Sodium tetrapyrophosphate likewise has been cut with the current quotation $5.20 per 100 lb. in bags. Other price declines included diacetone, the revised quotations for the technical being 7½¢ a lb. in tank cars, 8½¢ a lb. in drums, carlots and 9¢ a lb. for less than carlots. Another price development of importance consisted in the cancelling of the previously announced increase for carbon black. Hence the base price will be 2¼¢ a lb.

An innovation in the method of quoting on carbon tetrachloride went into effect at the first of the month when producers offered this material on a gallon or a drum basis. A zone system also has been set up. For the eastern territory, 66½¢ a gal. is quoted for 52½ gal. drums in carlot amounts.

A report from our commercial attache at Tokyo states that in view of increased demand for carbon bisulphide in Japan leading producers are drafting production expansion schemes. The Imperial Sulphur Co. recently completed erection of three furnaces with a total monthly capacity of 60 tons; subject to the approval of the general meeting of the Carbon Bisulphide Industrial Association, the furnaces were scheduled to start operations in November. The monthly capacity of this company will thereby be increased to 210 metric tons.

The Tohoku Chemical Co. will soon start operation of two furnaces involving a combined capacity of 30 metric tons monthly to increase the total capacity to 150 metric tons monthly. As a result of the production expansion undertaken by the leading companies, the total monthly productive capacity of carbon bisulphide makers at the end of September advanced to 13,190 metric tons, including 10,670 tons by members of the Carbon Bisulphide Industrial Association and 2,520 tons by non-members.

The Utsumi Chemical Industrial Co., a 170,000 yen company specializing in the production of carbon bisulphide in Yamaguchi Prefecture, is considering plans to increase its capitalization in order to expand its productive capacity. The company now has a monthly capacity of 200 metric tons.

From Italy comes the report that the Italian firm of Pirelli & Co., Milan, is using the German process of manufacturing carbon black from naphthalene and anthracine.

Canada has been expanding its consumption of naphthalene and for the 12 months ended March 30, 1938, imported 1,162,812 lb. compared with 830,771 lb. for the preceding 12 months.

Production of a new noncrystallizing gum rosin has been announced by the Bureau of Chemistry and Soils. The new product, a natural rosin obtained from pine gum, does not crystallize in ordinary usage.

The new rosin is made only from the liquid part of the gum. Its preparation is based on a recent finding by Bureau chemists that the semi-solid mass which forms when the gum is allowed to stand contains most of the crystallizable material. This mass is removed from the liquid part by straining or filtering through a light-weight muslin cloth. The straining takes from 24 to 48 hours as it must be done entirely by gravity. Pressure filters cannot be used as the high pressure would cause the semisolid crystalline mass to liquefy and mix again with the noncrystalline liquid. The straining removes the crystalline part of the resin, and also cleans the rosin by removing chips, bark, and fine suspended particles.

Semiplant scale tests have shown that production of the new rosin is commercially feasible. A public-service patent covering the new product has been applied for.

Production of crude methanol increased slightly in November but the total output for the 11-month period was only 3,812,847 gal. compared with 5,292,056 gal. for the like period of 1937. Synthetic methanol production showed a good gain in November but was considerably below the 1937 figure for that month and the 11-month totals likewise favor last year, the figures being 23,186,920 gal. and 27,926,305 gal. for 1938 and 1937 respectively.

Federal specifications for cold-water paste wall paint have been changed to meet criticism aimed at omission of a basis of classification according to the nonvolatile binder. The new specification covers two types, on the binder basis—Grade A, casein or other protein binder, and grade B, emulsified resin binder.

Camphor-yielding oil has been discovered in the Sudan, says an announcement by the Chemical Division, Bureau of Foreign and Domestic Commerce. The Division report quotes a statement from the Sudan government's chemist to the Imperial Institute, in sending a sample of ocimum oil, which was said to represent the total distillate (about 5 per cent) from the leaves of a plant, identified as Ocimum kilimandscharicum. The leaves had been stored for several months before distilling. According to the report, preliminary tests at Khartum indicated that the distillate consisted largely of camphor and terpenes.

Examination disclosed the fact that 62 per cent of solid camphor could be obtained from the distillate from filtration and compression, and that an additional 15 per cent probably could be obtained from the residual oil.

CHEM. & MET.

Weighted Index of

CHEMICAL PRICES

Base=100 for 1935

This month	**98.88**
Last month	99.01
January, 1938	89.31
January, 1937	87.26

Many price schedules have been revised for early 1939 deliveries but the basic chemicals have held at former levels with the exception of liquid chlorine which has been lowered. Sulphate of ammonia moved up automatically. Turpentine closed higher.

CHEM. & MET.

Weighted Index of Prices for

OILS AND FATS

Base= for 1935

This month	**75.64**
Last month	75.80
January, 1938	75.59
January, 1937	109.35

Price changes were numerous and in both directions. China wood oil is still an uncertain factor but reserve stocks are large and the market has not changed materially. Animal fats have been quiet and fairly steady.

Current PRICES

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.05½–$0.06½	$0.05½–$0.06½	$0.05½–$0.06½
Acid, acetic, 28%, bbl., cwt.	2.23 – 2.48	2.23 – 2.48	2.23 – 2.48
Glacial 99%, drums	8.43 – 8.68	8.43 – 8.68	8.43 – 8.68
U. S. P. reagent	10.25 –10.50	10.25 –10.50	10.25 –10.50
Boric, bbl., ton	106.00–111.00	106.00–111.00	105.00–115.00
Citric, kegs, lb.	.23½– .25	.23½– .25	.24 – .27
Formic, bbl., ton	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb.	.70 – .75	.70 – .75	.75 – .78
Hydrofluoric 30% carb., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Lactic, 44%, tech., light, bbl., lb.	.06½– .06½	.06½– .06½	.6½ – .6½
Muriatic, 18°, tanks, cwt.	1.05 –.....	1.05 –.....	1.05 –.....
Nitric, 36°, carboys, lb.	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –.....	18.50 –20.00
Oxalic, crystals, bbl., lb.	.10½– .12	.10½– .12	.10½– .12
Phosphoric, tech., c'bys., lb.	.07½– .08½	.07½– .08½	.09 – .10
Sulphuric, 60°, tanks, ton	13.00 –.....	13.00 –.....	13.00 –.....
Sulphuric, 66°, tanks, ton	16.50 –.....	16.50 –.....	16.50 –.....
Tannic, tech., bbl., lb.	.40 – .45	.40 – .45	.40 – .45
Tartaric, powd., bbl., lb.	.27½–	.27½–.....	.24½–.....
Tungstic, bbl., lb.	2.75 –.....	2.75 –.....	2.75 –.....
Alcohol, Amyl	–	–	–
From Pentane, tanks, lb.	.106–.....	.106–.....	.123–.....
Alcohol, Butyl, tanks, lb.	.08½–.....	.08½–.....	.08½–.....
Alcohol, Ethyl, 190p'f., bbl., gal.	4.61½–.....	4.61½–.....	4.14 –.....
Denatured, 190 proof			
No. 1 special, dr., gal wks.	.30 –.....	.30 –.....	.34 –.....
Alum, ammonia, lump, bbl., lb.	.03½– .04	.03½– .04	.03 – .04
Potash, lump, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Aluminum sulphate, com bags cwt.	1.15 – 1.40	1.15 – 1.40	1.35 – 1.50
Iron free, bg., cwt.	1.30 – 1.55	1.30 – 1.55	2.00 – 2.25
Aqua ammonia, 26°, drums, lb.	.02 – .03	.02 – .03	.02½– .03
tanks, lb.	.02 – .02½	.02 – .02½	.02½– .02½
Ammonia, anhydrous, cyl., lb.	.15½–.....	.15½–.....	.15½– .16
tanks, lb.	.04½–.....	.04½–.....	.04½–.....
Ammonium carbonate, powd tech., casks, lb.	.08 – .12	.08 – .12	.08 – .12
Sulphate, wks., cwt.	1.40–	1.3875–.....	1.425–.....
Amylacetate tech., tanks, lb.	.9½ –.....	.09½– .12	.11 – .11½
Antimony Oxide, bbl., lb.	.11½– .12	.11½– .12	.11½– .12
Arsenic, white, powd., bbl., lb.	.03 – .03½	.03 – .03½	.03 – .03½
Red, powd., kegs, lb.	.15½– .16	.15½– .16	.15½– .16
Barium carbonate, bbl., ton	52.50 –57.50	52.50 –57.50	52.50 –57.50
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, cask, lb.	.07 – .08	.07 – .08	.07 – .08
Blanc fixe, dry, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f. o b., wks., drums, cwt.	2.00 – 2.10	2.00 – 2.10	2.00 – 2.10
Borax, gran., bags, ton	48.00 –51.00	48.00 –51.00	46.00 –51.00
Bromine, cs., lb.	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	1.65 –.....	1.65 –.....	1.65 –.....
Arsenate, dr., lb.	.06½– .07	.06½– .07	.06½– .07
Carbide drums, lb.	.05 – .06	.05 – .06	.05 – .06
Chloride, fused, dr., del., ton	21.50 –24.50	21.50 –24.50	20.00 –33.00
flake, dr., del., ton	23.00 –25.00	23.00 –25.00	22.00 –35.00
Phosphate, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb.	.05 – .06	.05 – .06	.05 – .06
Tetrachloride drums, lb.	.04½– .05½	.04½– .05½	.05½– .06
Chlorine, liquid, tanks, wks., lb.	2.00 –.....	2.15 –.....	2.15 –.....
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb.	1.67 – 1.70	1.67 – 1.70	1.67 – 1.70
Copperas, bgs., f.o.b., wks., ton	15.00 –16.00	15.00 –16.00	15.00 –16.00
Copper carbonate, bbl., lb.	.10 – .16½	.10 – .16½	.09 – .16
Sulphate, bbl., cwt.	4.50– 4.75	4.50 – 4.75	4.50 – 4.75
Cream of tartar, bbl., lb.	.22½– .23	.22½– .23	.19½– .20
Diethylene glycol, dr., lb.	.22 – .23	.22 – .23	.22 – .23
Epsom salt, dom., tech., bbl., cwt.	1.80 – 2.00	1.80 – 2.00	1.80 – 2.00
Ethyl acetate, drums, lb.	.06½–.....	.06½–.....	.07½–.....
Formaldehyde, 40%, bbl., lb.	.05½– .06½	.05½– .06½	.05½– .6½
Furfural, dr., lb	.10 – .17½	.10 – .17½	.10 – .17½
Fusel oil, ref. drums, lb.	.12½– .14	.12½– .14	.12½– .14
Glaubers salt, bags, cwt.	.95 – 1.00	.95 – 1.00	.95 – 1.00
Glycerine, c.p., drums, extra, lb.	.12½–.....	.14½–.....	.15½–.....
Lead:			
White, basic carbonate, dry casks, lb.	.07 –.....	.07 –.....	.06½–.....
White, basic sulphate, sck., lb.	.06½–.....	.06½–.....	.06½–.....
Red, dry, sck, lb.	.0735–	.0 7½ –.....	.0735–
Lead acetate, white crys., bbl., lb.	.10 – .11	.10 – .11	.11 – .12
Lead arsenate, powd., bbl., lb.	.11 – .11½	.11 – .11½	.13 – .13½
Lime, chem., bulk, ton	8.50 –.....	8.50 –.....	8.50 –.....
Litharge, pwd., csk., lb.	.0635–	.0625–.....	.0635–
Lithophone, bags, lb.	.04½– .04½	.04½– .04½	.04½– .05
Magnesium carb., tech., bags, lb.	.06 – .06½	.06 – .06½	.06 – .06½

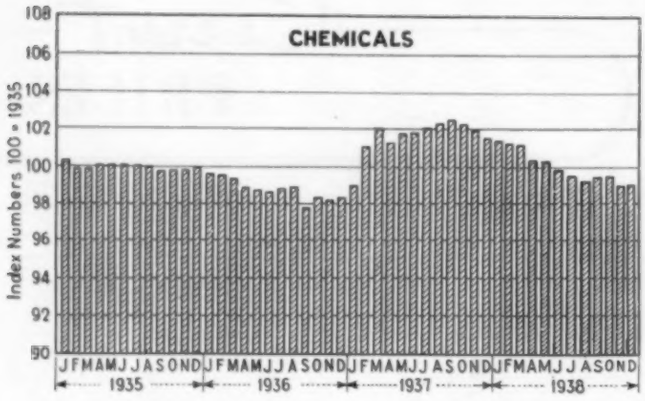
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Jan. 12

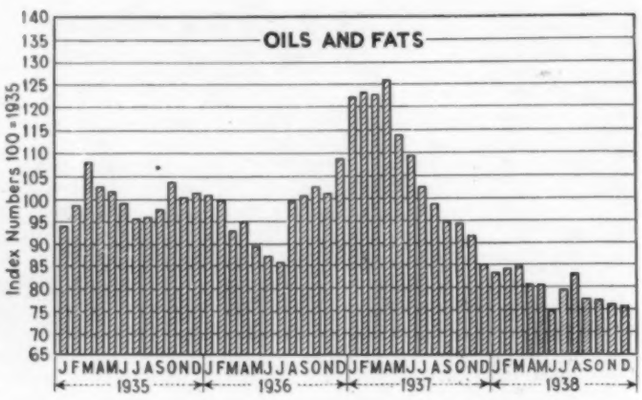
	Current Price	Last Month	Last Year
Methanol, 95%, tanks, gal.	.31 –.....	.31 –.....	.31 –.....
97%, tanks, gal.	.32 –.....	.32 –.....	.32 –.....
Synthetic, tanks, gal.	.33 –.....	.33 –.....	.33 –.....
Nickel salt, double, bbl., lb.	.13 – .13½	.13 – .13½	.13 – .13½
Orange mineral, csk., lb.	.10½–.....	.10½–.....	.10½–.....
Phosphorus, red, cases, lb.	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb.	.24 – .30	.24 – .30	.24 – .30
Potassium bichromate, casks, lb.	.08½– .09	.08½– .09	.08½– .09
Carbonate, 80–85%, calc. csk., lb.	.05½– .06	.05½– .06	.06½ .07
Chlorate, powd., lb.	.09½–.....	.09½–.....	.09½–.....
Hydroxide (c'stic potash) dr., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Muriate, 80% bgs., unit	.53½–.....	.53½–.....	.53½–.....
Nitrate, bbl. lb.	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb.	.18½– .19	.18½– .19	.18½– .19
Prussiate, yellow, casks, lb.	.15 – .16	.15 – .16	.15 – .16
Sal ammoniac, white, casks, lb.	.05 – .05½	.05 – .05½	.05 – .05½
Salsoda, bbl., cwt.	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	13.00 –15.00	13.00 –15.00	13.00 –15.00
Soda ash, light, 58%, bags, contract, cwt.	1.05 –.....	1.05 –.....	1.05 –.....
Dense, bags, cwt.	1.10 –.....	1.10 –.....	1.10 –.....
Soda, caustc, 76%, solid, drums, contract, cwt.	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, works, bbl., lb.	.04 – .05	.04 – .05	.04½– .05
Bicarbonate, bbl., cwt.	1.75 – 2.00	1.75 – 2.00	1.75 – 2.00
Bichromate, casks, lb.	.06½– .07	.06½– .07	.06½– .07
Bisulphate, bulk, ton	15.00 –16.00	15.00 –16.00	15.00 –16.00
Bisulphite, bbl., lb.	.03½– .04	.03½– .04	.03½– .04
Chlorate, kegs, lb.	.06½– .06½	.06½– .06½	.06½– .06½
Chloride, tech., ton	12.00 –14.75	12.00 –14.75	12.00 –14.75
Cyanide, cases, dom., lb.	.14 – .15	.14 – .15	.16½– .17
Fluoride, bbl., lb.	.07½– .08	.07½– .08	.07½– .08
Hyposulphite, bbl., cwt.	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt.	2.20 – 3.20	2.20 – 3.20	2.15 – 3.15
Nitrate, bags, cwt.	1.45 –.....	1.45 –.....	1.45 –.....
Nitrite, casks, lb.	.06½– .07	.06½– .07	.07 – .08
Phosphate, dibasic, bags, lb.	1.85 –.....	1.85 –.....	1.85 – .024
Prussiate, yel. drums, lb.	.09½– .10	.09½– .10	.10 – .11
Silicate (40° dr.) wks., cwt.	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr., lb.	.02½– .03½	.02½– .03	.02½– .03
Sulphite, cyrs., bbl., lb.	.02½– .02½	.02½– .02½	.02½– .02½
Sulphur, crude at mine, bulk, ton	16.00 –.....	16.00 –.....	18.00–.....
Chloride, dr., lb.	.03 – .04	.03 – .04	.03½– .04
Dioxide, cyl., lb.	.07 – .08	.07 – .08	.07 – .07½
Flour, bag, cwt.	1.60 – 3.00	1.60 – 3.00	1.60 – 3.00
Tin Oxide, bbl., lb.	.50 –.....	.50 –.....	.48 –.....
Crystals, bbl., lb.	.36½–.....	.36 –.....	.34 –.....
Zinc, chloride, gran., bbl., lb.	.05 – .06	.05 – .06	.05 – .06
Carbonate, bbl., lb.	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb.	.33 – .35	.33 – .35	.36 – .38
Dust, bbl., lb.	.06½–.....	.06½–.....	.075–.....
Zinc oxide, lead free, bag., lb.	.06½–.....	.06½–.....	.06½–.....
5% lead sulphate, bags, lb.	.06½–.....	.06½–.....	.06½–.....
Sulphate, bbl., cwt.	3.15 – 3.60	3.15 – 3.60	3.15 – 3.60

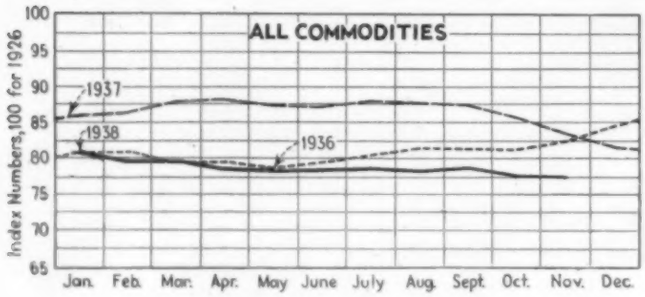
OILS AND FATS

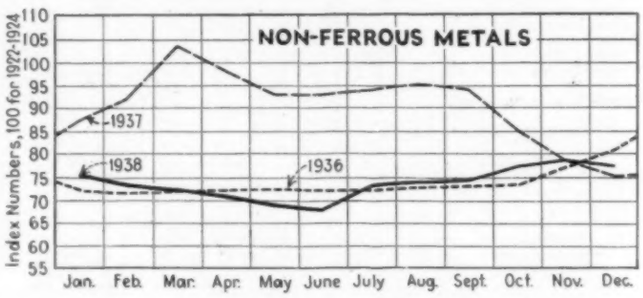
	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.09½–$0.10	$0.09½–$0.10	$0.09½–$0.10
Chinawood oil, bbl., lb.	.15½–.....	.14½–.....	.15½–.....
Coconut oil, Ceylon, tanks, N. Y. lb.	.03 –.....	.03½–.....	.04½–.....
Corn oil crude, tanks (f.o.b. mill), lb.	.06½–.....	.06½–.....	.06½–.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb.	.06½–.....	.06½–.....	.06 –.....
Linseed oil, raw car lots, bbl., lb.	.085–.....	.085–.....	.102–.....
Palm, casks, lb.	.03½–.....	.03½–.....	.04 –.....
Peanut oil, crude, tanks (mill), lb.	.06½–.....	.06½–.....	.06½–.....
Rapeseed oil, refined, bbl., gal.	.80 –.....	.82 –.....	.90 –.....
Soya bean, tank, lb.	.05½–.....	.05½–.....	.06 –.....
Sulphur (olive foots), bbl., lb.	.07 –.....	.07 –.....	.08 –.....
Cod, Newfoundland, bbl., gal.	.38 –.....	.38 –.....	.52 –.....
Menhaden, light pressed, bbl., lb	.071–.....	.067–.....	.074–.....
Crude, tanks (f.o.b. factory), gal	.32 –.....	.30 –.....	.37½–.....
Grease, yellow, loose, lb.	.04½–.....	.05 –.....	.04½–.....
Oleo stearine, lb.	.06½–.....	.06½–.....	.09 –.....
Oleo oil, No. 1	.08½–.....	.09½–.....	.09 –.....
Red oil, distilled, d.p. bbl., lb.	.07½–.....	.07½–.....	.09½–.....
Tallow extra, loose, lb.	.05½–.....	.05½–.....	.06½–.....

Chem. & Met.'s Weighted Price Indexes









COAL-TAR PRODUCTS

	Current Price	Last Month	Last Year
Alpha-napthol, crude, bbl., lb.	$0.52 -$0.55	$0.52 -$0.55	$0.52 -$0.55
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.15 - .16	.15 - .16	.15 - .16
Aniline salts, bbl., lb.	.22 - .24	.22 - .24	.22 - .24
Benzaldehyde, U.S.P., dr., lb.	.85 - .95	.85 - .95	.85 - .95
Benzidine base, bbl., lb.	.70 - .75	.70 - .75	.70 - .75
Benzoic acid, U.S.P., kgs., lb.	.54 - .56	.54 - .56	.52 - .54
Benzyl chloride, tech., dr., lb.	.23 - .25	.23 - .25	.25 - .27
Benzol, 90%, tanks, works, gal.	.16 - .18	.16 - .18	.16 - .18
Beta-napthol, tech., drums, lb.	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb.	.10 - .11	.10 - .11	.12 - .13
Cresylic acid, dr., wks., gal.	.69 - .71	.69 - .71	.89 - .92
Diethylaniline, dr., lb.	.40 - .45	.40 - .45	.50 - .55
Dinitrophenol, bbl., lb.	.23 - .25	.23 - .25	.23 - .25
Dinitrotoluen, bbl., lb.	.15 - .16	.15 - .16	.15 - .16
Dip oil, 15%, dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, bbl., lb.	.32 - .36	.32 - .36	.32 - .36
H-acid, bbl., lb.	.50 - .55	.50 - .55	.50 - .55
Naphthalene, flake, bbl., lb.	.05½- .06	.05½- .06	.07½- .07½
Nitrobensene, dr., lb.	.08 - .09	.08 - .09	.08 - .09
Para-nitraniline, bbl., lb.	.47 - .49	.47 - .49	.45 - .47
Phenol, U.S.P., drums, lb.	.14½-	.14½-	.14½-
Picric acid, bbl., lb.	.35 - .40	.35 - .40	.35 - .40
Pyridine, dr., gal.	1.55 - 1.60	1.55 - 1.60	1.55 - 1.60
Resorcinal, tech., kegs, lb.	.75 - .80	.75 - .80	.75 - .80
Salicylic acid, tech., bbl., lb.	.33 - .40	.33 - .40	.34 - .40
Solvent naptha, w.w., tanks, gal.	.26 -	.26 -	.30 -
Tolidine, bbl., lb.	.86 - .88	.86 - .88	.88 - .90
Toluene, tanks, works, gal.	.27 -	.27 -	.35 -
Xylene, com, tanks, gal.	.26 -	.26 -	.35 -

MISCELLANEOUS

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.08½- .11	.08 - .11	.10½- .12
China clay, dom., f.o.b. mine, ton.	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors			
Carbon gas, black (wks.), lb.	.02½- .30	.02½- .30	.0295 - .30
Prussian blue, bbl., lb.	.36 - .37	.36 - .37	.36 - .37
Ultramarine blue, bbl., lb.	.10 - .26	.10 - .26	.10 - .26
Chrome green, bbl., lb.	.21 - .30	.21 - .30	.21 - .27
Carmine red, tins, lb.	4.00 - 4.40	4.00 - 4.40	4.00 - 4.40
Para toner, lb.	.75 - .80	.75 - .80	.75 - .80
Vermilion, English, bbl., lb.	1.50 - 1.55	1.50 - 1.55	1.60 - 1.65
Chrome yellow, C. P., bbl., lb.	.14½- .15½	.14½- .15½	.14½ - .15½
Feldspar, No. 1 (f.o.b. N.C.), ton.	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.06 - .06½	.06 - .06½	.06 - .06½
Gum copal Congo, bags, lb.	.06 - .30	.06 - .30	.08 - .30
Manila, bags, lb.	.07 - .14	.07 - .14	.09 - .14
Damar, Batavia, cases, lb.	.16 - .24	.16 - .24	.16 - .24
Kauri cases, lb.	.17½- .60	.17½- .60	.18½- .60
Kieselguhr (f.o.b. N. Y.), ton.	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton.	50.00 -	50.00 -	50.00 -
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .04	.03 - .04	.03 - .04
Rosin, H., bbl.	6.10 -	5.75 -	7.20 -
Turpentine, gal.	.30 -	.27½-	.32½-
Shellac, orange, fine, bags, lb.	.20 -	.20 -	.21 -
Bleached, bonedry, bags, lb.	.19 -	.19 -	.17 -
T. N. Bags, lb.	.10½-	.10½-	.12 -
Soapstone (f.o.b. Vt.), bags, ton.	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
300 mesh (f.o.b. Ga.), ton.	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N. Y.), ton.	13.75 -	13.75 -	13.75 -

INDUSTRIAL NOTES

REICHOLD CHEMICALS, INC., Detroit, has acquired control of the Fred L. Lavanburg Co., Brooklyn.

WORTHINGTON PUMP AND MACHINERY CORP., Harrison, N. J., has transferred Edward Watson, refrigeration and air conditioning engineer, from the home office to Atlanta.

U. S. INDUSTRIAL ALCOHOL CO., New York, announces that from the first of the year, manufacturing and selling activities of the company are conducted by its subsidiary, U. S. Industrial Chemicals, Inc., formerly known as U. S. Industrial Alcohol Sales Co., Inc.

THE BLACKMER PUMP CO., Grand Rapids, Mich., has appointed G. H. Schneider as its representative in Indiana and Ohio with headquarters in Indianapolis.

BARIUM AND CHEMICALS, INC., Willoughby, Ohio, successor to The J. H. R. Products Co., has announced through its president, Norbert Stern, that Dr. M. J. Rentschler will continue as director of research.

PITTSBURGH PIPING & EQUIPMENT CO., Pittsburgh, has appointed S. J. Martin manager of the engineering department.

THE ALLEN-BRADLEY CO., Milwaukee, has appointed the Industrial Machinery Co., Great Falls, Mont., and West L. Powell, Erie, Pa., as its representatives.

WISHNICK-TUMPEER, INC., New York, has transferred C. A. Damen from New York to manage its Boston branch.

GOETZE GASKET & PACKING CO., INC., New Brunswick, N. J., is now represented in Canada by Atlas Asbestos Co., Ltd., Montreal.

ARMSTRONG CORK CO., Lancaster, Pa., has purchased the Hart Glass Mfg. Co., Dunkirk, Ind., which will continue to operate under the same management.

New CONSTRUCTION

PROPOSED WORK

Aluminum Products Factory—Aluminum Co. of Canada, Ltd., O. M. Montgomery, Gen. Mgr., 1010 St. Catherine St., W., Montreal, Que., has purchased a site at Cobourg, Ont., Can., and plans to construct a factory for the fabrication of aluminum products. Estimated cost $150,000.

Artificial Silk Plant—Syndicate, c/o G. C. Miller, Mayor, City Hall, Vancouver, B. C., Can., is having plans prepared for the construction of an artificial silk manufacturing plant. Estimated cost $300,000.

Chemical Plant—Hooker Electrochemical Co., Buffalo Ave., Niagara Falls, N. Y., plans to construct an addition to its plant. W. A. Cannon, 2637 Main St., Niagara Falls, Archt. Estimated cost will exceed $100,000.

Chemical Plant—Monsanto Chemical Co., W. Flaws, Engr., Chemical Lane, Everett, Mass., contemplates the construction of a 2 story plant. Estimated cost $50,000.

Creosoting Plant—Canada Creosoting Co., Canadian Pacific Ry. Bldg., Toronto, Ont., Can., plans to construct and equip a plant for creosoting railway ties, bridge timber, etc., also dock, at Port Arthur, Ont. Estimated cost $35,000.

Creosoting Plant—Lincoln Creosoting Co., C. A. Tooke, Vice Pres., Shreveport, La., plans to construct a creosoting plant at Heber Springs, Ark., to have a treating capacity of three to five carloads per day. Estimated cost $100,000.

Gypsum Plant—National Gypsum Co., D. F. Wolf, Mgr., 190 Delaware Ave., Buffalo, N. Y., plans to rebuild that portion of its plant at Niles, O., which was recently destroyed by fire.

Oil Refinery—Onondaga Refiners, Norman McDonald, Mgr., 42 George St., Brantford, Ont., Can., have purchased a factory near Brantford, Ont., and will alter same and install complete machinery and equipment for an oil refinery. The Company is interested in prices of all equipment. Estimated cost $25,000.

Oil Refinery—Svend Thomson, Grand Valley, Ont., Can., is having plans prepared for the construction of an oil refinery. Estimated cost $70,000.

Oil Pipe Line—Humble Oil & Refining Co., 600 ElPaso St., San Antonio, Tex., plans to construct new crude oil pipe lines in area of Kelsey Field in southeastern Jim Hogg County, McAllen, Tex. Estimated cost $500,000.

Paint Factory—International Paints of Canada, Ltd., 6700 Park Ave., Montreal, Que., Can., has purchased a site and plans to construct an addition to its plant. Estimated cost $100,000.

Paper Mill—Marathon Paper Mills, Menasha, Wis., contemplate the construction of a 2 story, 110x300 ft. mill and office building. F. Gruper, c/o Owner, Ch. Engr.

Where Plants Are Being Built in Process Industries

	Current Projects		Cumulative 1938	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$50,000	$40,000	$395,000	$1,259,000
Middle Atlantic	1,180,000	138,000	10,739,000	10,098,000
South	540,000	.....	38,660,000	12,586,000
Middle West	270,000	.....	15,602,000	10,322,000
West of Mississippi	640,000	190,000	19,847,000	7,855,000
Far West	.....	.....	1,335,000	3,409,000
Canada	820,000	75,000	23,719,000	5,805,000
Total	$3,500,000	$443,000	$110,297,000	$51,334,000

Recycling Plant—American Liberty Oil Co., Grapeland, Tex., plans to construct a recycling plant for recycling wet gas obtained in the Grapeland field, also several miles of pipe line.

Rubber Mills—Goodyear Tire & Rubber Co., 1144 East Market St., Akron, O., plans to construct additions to its mills at Cedartown and Cartersville, Ga.

Salt Factory—Dominion Tar & Chemical Co., Ltd., L. O. P. Walsh, Pres., 606 Cathcart St., Montreal, Que., Can., has acquired the salt factory formerly owned by Industrial Minerals, Ltd., at Waterways, Alta., Can., and will extend and improve same early in 1939. Estimated cost $100,000.

Soap Factory—Andrew Jergens Co., 2535 Spring Grove Ave., Cincinnati, O., plans to construct a manufacturing plant at Belleville, N. J. Estimated cost $1,000,000.

Soap Factory—J. B. Williams Co. of Canada, Ltd., 9471 Blvd. LaSalle, Ville La Salle, Que., Can., is having plans prepared for an addition to its factory. Estimated cost $40,000.

Soap Warehouse—Proctor & Gamble Co., manufacturer of soaps, etc., 1232 West North Ave., Chicago, Ill., is receiving bids for the construction of a 2 story and basement, 100x200 ft. warehouse at 1614 North Magnolia Ave., Chicago. Jensen & Teuch, 1105 West Lawrence Ave., Chicago, Archts. Estimated cost $150,000.

Sugar Mill—Southdown Sugar Mills, Houma, La. (operators), Realty Operators, Inc., c/o Newton Kearney, Sugar Marine Bldg., New Orleans, La., plan to reconstruct sugar mill recently destroyed by fire. All new equipment and machinery will be installed. Estimated cost $500,000.

Sulphite Mill—Detroit Sulphite Pulp & Paper Co., 9125 West Jefferson St., Detroit, Mich., will soon take bids for the construction of a 1 story, 100x100 ft. mill.

Sulphite Mill—Morristown Sulphite Mill, Morristown, N. Y., contemplates the construction of an addition to its mill.

Warehouse—American Agricultural Chemical Co., 50 Church St., New York, N. Y., plans to construct a warehouse at Syracuse, N. Y. Estimated cost will exceed $40,000.

CONTRACTS AWARDED

Chemical Laboratory—Cole Chemical Co., Inc., B. L. Cole, Pres., 3721 Laclede Ave., St. Louis, Mo., has awarded the contract for the construction of a chemical laboratory to S. C. Mullgardt and E. C. Hartman, Inc., 4485 Olive St., St. Louis. Estimated cost $75,000.

Ethyl Cellulose Plant—Hercules Powder Co., Inc., Delaware Trust Bldg., Wilmington, Del., will start work at once on the construction of an ethyl cellulose plant at Hopewell, Va.

Factory—Porocel Corporation c/o C. M. Shaeffer, Vice Pres., Little Rock, Ark., has awarded the contract for the first unit of a plant for the manufacture of "Porocel," a substitute for Fuller's Earth, to G. W. May, 4501 Asher St., Little Rock.

Factory—Shawinigan Resins Corp., Worcester St., Indian Orchard, Mass., has awarded the contract for the construction of a 1- and 3- story, 42x100 ft. factory to Adams & Ruxton Construction Co., 1387 Main St., Springfield, Mass. Estimated cost $40,000.

Lime Burning Kilns—Gypsum Lime & Alabastine Co., Paris, Ont., Can., will start work immediately on the construction of two lime burning kilns. Estimated cost $75,000.

Processing Plant—Suchar Process Corp., 120 Wall St., New York, N. Y., plans to alter and construct additions to its processing plant at Yonkers, N. Y. Work will be done by owner. Estimated cost $97,500.

Steel Storage Tanks—Taylor Refining Co., Corpus Christi, Tex., will construct two 55,000 bbl. capacity steel storage tanks in Neuces Co., west of Corpus Christi. Work will be done by owner. Preliminary work is under way. Estimated cost $75,000.

DIGEST OF COMMODITIES AFFECTED BY TRADE AGREEMENT WITH UNITED KINGDOM

IN connection with the Trade Agreement between the United States and the United Kingdom which went into effect at the beginning of this year, the U. S. Tariff Commission has issued a digest which gives salient facts regarding the commodities on which preferential import rates have been granted to the United Kingdom. Excerpts from this digest show the following for the specified commodities:

Precipitated Magnesium Carbonate

Under the agreement, duty is reduced from 1½¢ a lb. to 1¢ a lb. Imports in 1937 were 1,042,900 lb. with more than 60 per cent of this coming from the United Kingdom.

The bulk of domestic production is consumed at producing plants in making "85 per cent magnesia" insulation. Material sold is used in rubber goods, printing inks, paints, pigments, varnishes, and free-flowing table salt.

Domestic production for sale for 1935 was given at 14,602,000 lb. valued at $877,741. This does not include the large production consumed at producing plants. In 1936, the capacity for producing the carbonate in the dry form in which it is sold totaled about 27,000,000 lb.

Precipitated Chalk

Imports of precipitated chalk have been increasing in recent years with the United Kingdom the principal supplier. The drop in duty from 25 per cent to 15 per cent should favor still larger imports. In 1937, imports were 7,592,894 lb. compared with 6,647,313 lb. in 1936 and 6,057,304 lb. in 1935.

Figures for domestic production are not published. In 1926 it was estimated that production exceeded 3,000,000 lb. In 1932, sales of the domestic product amounted to 7,502,563 lb. and imports were reported at 4,854,344 lb. Indications are that domestic production has doubled since 1932.

Primary raw materials are limestone and carbon dioxide and three companies, operating four plants, account for the domestic output. All these producers consume limestone for other purposes. Two of the plants are operated by an affiliate of a large producer of paper pulp.

Principal use for precipitated chalk is in the manufacture of tooth paste and powder. It is also used as a filler in making cigarette and other paper; in preparing shaker salt; as a neutralizing agent in fermentation processes; for medicinal purposes; as an anti-acid; as a base for certain cosmetics; and in replacing magnesium carbonate in the manufacture of rubber heels and soles.

Cresols

The general tariff classification makes cresols dutiable at the rate of 40 per cent ad val. and 7¢ a lb. The trade agreement specifies that metacresol, orthocresol, and paracresol having a purity of 75 per cent or more but less than 90 per cent and metaparacresol of 75 per cent or more will carry a duty of 20 per cent and 3½¢ a lb. Orthocresol having a purity of 90 per cent or more is reduced from 20 per cent and 3½¢ a lb. to 10 per cent and 1¾¢ a lb. Metacresol and paracresol of 90 per cent or more purity is reduced to 15 per cent and 3½¢ a lb.

The three cresols are isomeric tar acids obtained from coal-tar by distillation. They are marketed in several types and grades. Principal uses are in synthetic resins, except orthocresol which is used in disinfectants, antiseptics, and germicides. Other uses of the cresols are in explosives, photographic developers, dye intermediates, and in medicine.

In 1937 there were five producers of the mixed cresols; three producers of separated orthocresol and meta-para mixture; and two of separated meta and separated orthocresol. Because of the small number of producers, most of the production statistics are not publishable. In 1937 production of the unseparated natural mixture of cresols was 13,745,000 lb.

Imports of cresols in 1937 were reported at 167,278 lb. with the United Kingdom furnishing the great part of that total.

Ammonium Carbonate and Bicarbonate

Commercial ammonium carbonate is the double salt of ammonium bicarbonate and ammonium carbamate. One of its principal uses is in baking powders where it competes with yeast. A similar use is in the manufacture of sponge rubber goods and tennis balls. Other uses are in the production of cocoa, casein glues and adhesives, certain types of dyes, wool-scouring preparations, detergents, fire extinguishing compounds, medicinals such as heart stimulants, external lotions, and smelling salts. Ammonium bicarbonate is closely related to the carbonate and substitutes for it in many uses.

Domestic production of ammonium carbonate and bicarbonate is estimated at about 2,200,000 lb. annually. From 1934 to date imports have been about seven and one-half per cent of domestic production. Recently production has been largely confined to three companies, one a producer of soda ash and synthetic ammonia, the second produces a wide range of nitrogen products from synthetic ammonia, and the third, primarily a manufacturer of fertilizer and glue, produces ammonium carbonate as a byproduct of bone char. Principal consuming area lies east of the Mississippi and north of the Ohio River and Virginia.

During recent years, the larger part of imports came from the United Kingdom but for the first half of 1938, imports were reported at 137,216 lb. of which 93,486 lb. came from Germany and 43,730 lb. from the U. K.

Both the carbonate and bicarbonate are more important in Germany and Great Britain than in the United States. It is understood that Germany and Great Britain are developing a method of large-scale production of the carbonates at by-product coke-ovens for use as fertilizers.

Sodium Alginate

This white powder is produced from seaweed found off the Pacific Coast and off the coasts of Ireland, Scotland, Norway, and France. The raw kelp is treated with hot water to remove soluble salts, then with sodium carbonate to form crude sodium alginate. This is purified by conversions to alginic acid, calcium alginate, and finally to refined sodium alginate. Its principal use in the United States is as a stabilizer in ice cream. It is also used in sizing cloth, in waterproofing paper, and as a suspension agent in chocolate milk.

The only domestic producer operates in California and has turned out substantial amounts in recent years but production totals are not given. Imports represent but a small part of domestic production.

Stearic Acid

General import duty is on basis of 25 per cent ad val. Under new agreement, material valued at more than 8¢ per lb. is dutiable at 15 per cent ad val. In 1937, average value for imports were 11¢ per lb. from United Kingdom; 9¢ per lb. from Netherlands; 7¢ per lb. from Belgium; 5¢ per lb. from Japan; and 6¢ per lb. from all other countries.

Stearic acid is produced jointly with oleic acid from oils and fats with glycerine and tar as byproducts. For each pound of stearic acid, there is produced about one and one-half pounds of oleic acid. Stearic acid is designated as saponified or distilled depending on process of manufacture. Grades are distinguished as single, double, and triple pressed. Single-pressed is used largely in manufacture of rubber and in lubricants; double-pressed in shaving creams, buffing compounds, and textile sizes; triple-pressed in cosmetics, pharmaceuticals, and decorated candles.

Technical Societies and Trade Associations

AIR CONDITIONING Mfrs.' Assn. Exec. Vice-Pres., William B. Henderson, 717 Southern Bldg., Washington, D. C.

Aluminum Research Institute. (Secondary Aluminum Ingot) R. D. T. Hollowell, 308 West Washington St., Chicago, Ill.

Amer. Assn. for the Advancement of Science. Perm. Sec., F. R. Moulton, Smithsonian Inst. Bldg., Washington, D. C.

Amer. Assn. of Cereal Chemists. Treas., Oscar Skovholt, c/o Quality Bakers of America, 120 W. 42nd St., New York.

Amer. Assn. of Engrs. Sec., M. E. McIver, 8 S. Michigan Blvd., Chicago, Ill.

Amer. Assn. of Textile Chemists & Colorists. Sec., Dr. H. C. Chapin, c/o Lowell Textile Institute, Lowell, Mass.

Amer. Bakers Assn. Pres., L. J. Schumaker; Sec., Tom Smith, 1135 Fullerton Ave., Chicago, Ill.

Amer. Bureau of Metal Statistics. Dir., W. R. Ingalls, 33 Rector St., New York.

Amer. Ceramic Society. Gen. Sec., Ross C. Purdy, 2525 N. High St., Columbus, Ohio.

Amer. Chemical Society. Sec., Dr. Charles L. Parsons, Mills Bldg., Washington, D. C.

Amer. Concrete Institute. Sec., Harvey Whipple, 408 New Center Bldg., Detroit, Mich.

Amer. Drug Mfrs.' Assn. Exec. Vice-Pres.-Sec., Carson P. Frailey, 506 Albee Bldg., Washington, D. C.

Amer. Electro-Platers' Society. Exec. Sec., W. J. R. Kennedy, 90 Maynard St., Springfield, Mass.

Amer. Foundrymen's Assn. Sec., R. E. Kennedy, 222 W. Adams St., Chicago, Ill.

Amer. Gas Assn. Man. Dir., Alexander Forward, 420 Lexington Ave., New York.

Amer. Gum Importers Assn., Inc. Sec.-Treas., John M. Young, 360 Furman St., Brooklyn, N. Y.

Amer. Institute Laundry. Drawer 1187, Joliet, Illinois.

Amer. Institute of Chemical Engrs. Sec., S. L. Tyler, 29 W. 39th St., New York.

Amer. Institute of Chemists. Sec., Howard S. Neiman, 2110 Woolworth Bldg., New York.

Amer. Institute of Consulting Engrs., Sec.-Treas., Philip W. Henry, 75 West St., New York.

Amer. Institute of Electrical Engrs. Nat. Sec., H. H. Henline, 33 West 39th St., New York.

Amer. Institute of Mining & Metallurgical Engrs. Sec., A. B. Parsons, 29 W. 39th St., New York.

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